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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 11, NUMBER 20
OCTOBER 15, 1978

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 11, NUMBER 20
OCTOBER 15, 1978

W78-09301 -- W78-09800

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the BioScience Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

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01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
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04 WATER QUANTITY MANAGEMENT AND CONTROL
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06 WATER RESOURCES PLANNING
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10 SCIENTIFIC AND TECHNICAL INFORMATION
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ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

PREDICTING BASE FLOW USING HYDROGEOLOGIC PARAMETERS,
Agricultural Research Service, Chickasha, OK. Southern Great Plains Watershed Research Center.
For primary bibliographic entry see Field 4D.
W78-09334

SENSITIVITY OF OPTIMIZED PARAMETERS IN WATERSHED MODELS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
R. G. Mein, and B. M. Brown.
Water Resources Research, Vol. 14, No. 2, p 299-303, April 1978. 1 fig, 2 tab, 12 ref.

Descriptors: *Model studies, *Watersheds(Basins), *Simulation analysis, *Methodology, *Hydrologic data, Analytical techniques, Statistics, Optimization, Forecasting, Geomorphology, *Boughton model, Ungaged watersheds, Parameters.

Models which attempt to simulate specifically each of the important hydrologic components of the watershed response appear to have more potential than black box models for predicting the effect of land use change, for application to ungaged watersheds, and for general studies of the effects of each process on watershed runoff. It has been common practice to evaluate some or all parameters of watershed models by fitting procedures. A methodology was presented by which the variance of each fitted parameter of a watershed model can be determined. This information can be used to determine the degree to which the model parameters can be related to physical characteristics. The method was illustrated by applying the Boughton model to several watersheds and by examining the coefficient of variation of each optimized parameter. (Singh-ISWS)
W78-09345

THE IMPACT OF SEASONAL FLOW CHARACTERISTICS AND DEMAND PATTERNS ON REQUIRED RESERVOIR STORAGE,
Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W78-09350

A MOISTURE-ACCOUNTING WATERSHED MODEL FOR SINGLE-STORM EVENTS BASED ON TIME-AREA CONCEPT,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
R. Krzysztofowicz, and M. H. Diskin.
Journal of Hydrology, Vol. 37, No. 3/4, p 261-294, May 1978. 12 fig, 7 tab, 15 ref, 1 append.

Descriptors: *Model studies, *Storm runoff, *Watersheds(Basins), *Runoff forecasting, Rainfall-runoff relationships, Mathematical models, Discharge(Water), Base flow, Hydrology, Rivers, Moisture content, Analytical techniques, Rainfall, Hydrologic cycle, Hydrograph analysis, Hydrographs, Floods, Flood discharge, Soil moisture, Surface runoff, Foreign countries, *Poland, *Raba River(Poland).

A watershed model for simulating a total runoff hydrograph due to a single storm was formulated. Two concepts form the basis of the model: (1) The rainfall variability over the area is accounted for by a multiple input resulting from the subdivision of the watershed into zones. (2) The division of the total rainfall input into various components is accomplished through a moisture-accounting procedure of the upper soil layer. The model was applied to the Raba River in southern Poland. An interactive process of identification of the model parameters was described, and the results of the calibration were presented. Both the results and sensitivity analysis indicated the robustness and usefulness of the model developed. The model as described appears to be very sensitive to initial moisture conditions in the upper soil layer of the various zones into which the watershed is divided. It appears that further research is needed for developing soil moisture indices based either on antecedent rainfall in each zone separately or on a combination of antecedent rainfall and rate of base flow for the few days preceding the day of the storm occurrence. (Humphreys-ISWS)
W78-09351

HYDROLOGIC RESPONSE MODEL OF THE NORTH AMERICAN GREAT LAKES,
National Oceanic and Atmospheric Administration, Ann Arbor. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 2H.
W78-09352

AGRICULTURE RUNOFF MANAGEMENT (ARM) MODEL--VERSION II. REFINEMENT AND TESTING,
Hydrocomp, Inc., Palo Alto, CA.
For primary bibliographic entry see Field 5B.
W78-09444

COMPARISON OF NUMERICAL AND PHYSICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2L.
W78-09477

PLAYER'S GUIDE. THE RIVER BASIN MODEL.
Washington Environmental Research Center, DC. Environmental Studies Div.
For primary bibliographic entry see Field 6A.
W78-09522

CALIBRATION OF A MATHEMATICAL MODEL OF THE ANTELOPE VALLEY GROUND-WATER BASIN, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W78-09741

2B. Precipitation

OPERATIONAL HYDROMETEOROLOGICAL DATA COLLECTION SYSTEM FOR THE COLUMBIA RIVER,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09326

HYDROLOGICAL ASPECTS OF THE DROUGHT EVENT IN NIGERIA-1972/1973,
Lagos Univ. (Nigeria). Dept. of Civil Engineering.
J. O. Sonuga.
Hydrological Sciences Bulletin, Vol. 22, No. 4, p 487-502, December 1977. 8 fig, 5 tab, 16 ref.

Descriptors: *Droughts, *Rainfall, *Variability, *Africa, Precipitation(Atmospheric), Moisture deficit, Water shortage, Data processing, Time series analysis, Correlation analysis, Distribution patterns, Persistence, Weather data, Meteorological data, Gaging stations, Runoff, Water levels, Lakes, Groundwater, Climatic data, Climatology, *Nigeria, *Lake Chad(Nigeria).

The drought event which reached severe levels in 1972 and 1973 caused a major disaster in the Sahalian and sub-Sahalian zones in Africa. This disaster has drawn attention to the need for data surveys and detailed studies for meaningful long-term measures to combat the effects of future droughts. The study reported in this paper was an attempt to assess the hydrological aspects of the drought event in Nigeria in 1972 and 1973. There exist relatively long and reliable records of rainfall within the drought zone, while records for runoff, water level and groundwater are few and far between. Data available were analyzed to determine evidence of trend and persistence (short and long-term). An examination of the rainfall records showed that extreme dry years at all the stations tended to recur at about the same time. The time interval between these extreme dry years was about 30 years. It also was observed from the spectral analysis of the records that most of the spectra for all the stations showed a generally high level of variance at low frequency. The limited information on runoff and groundwater precluded a detailed statistical analysis from being carried out on the annual series of runoff. However, the runoff data at some stations showed that the magnitude of runoff in the drought year 1972/1973 was about 22-72% of the average value for the length of record available (about eight years). Moreover, the long-term water-level record of Lake Chad revealed a similar trend for the occurrence of extreme dry years to that observed in the rainfall record. (Sims-ISWS)
W78-09333

ANNUAL AMPLITUDE OF PRECIPITATION IN THE USSR,
Ts. A. Shver.
Soviet Hydrology: Selected Papers, Vol. 15, No. 4, p 276-280, 1976. 1 fig, 5 tab, 4 ref. Translated from Transactions of the Main Geophysical Observatory (Trudy GGO), No. 349, p 175-182, 1976.

Descriptors: *Precipitation(Atmospheric), *Distribution patterns, *Foreign countries, Annual, Foreign research, Analytical techniques, Areal, Maps, Rainfall disposition, Meteorology, *USSR.

To compile a background map of the absolute annual amplitudes of precipitation, detailed (1:7,500,000) monthly maps reflecting the macro- and mesoclimatic precipitation distribution patterns were used. From the maps, the total amounts of precipitation were taken at the nodes of the coordinate grid every 1 deg of latitude and longitude. Then for each node, the difference (in mm) between the monthly precipitation maxima and minima was computed. The annual precipitation amplitude over most of the European USSR somewhat exceeds 40 mm and 50 mm in some places (upper reaches of the Dnieper River). It is less than 40 mm in the northern and southern parts of this region. By comparison with the European USSR, the annual amplitude in Siberia north of 60 deg N increases by an average of 10 mm, reaching 50 mm or more in some places. The highest value of annual amplitude of precipitation, of about 100-125 mm, is observed in Transbaykalia and in the Maritime Territory and also in some places in the Caucasus and in the mountains of Soviet Central Asia. The lowest annual amplitude of precipitation, about 15-20 mm, is recorded in Kazakhstan. (Humphreys-ISWS)
W78-09337

TRANSFERS ACROSS AN AIR-WATER INTERFACE AT HIGH WIND SPEEDS: THE EFFECT OF SPRAY,
Stanford Univ., CA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2L.
W78-09341

RAINFALL DEPTH-DURATION-FREQUENCY STUDIES FOR SRI LANKA,
Halcrow (William) and Partners, London (England).
V. R. Baghirathan, and E. M. Shaw.
Journal of Hydrology, Vol. 37, No. 3/4, p 223-239, May 1978. 2 fig, 6 tab, 7 ref.

Descriptors: *Rainfall, *Hydrologic data, *Duration curves, *Frequency curves, Analytical techniques, Data collections, Frequency, Foreign research, Foreign countries, Statistical methods, Mathematical models, Regional analysis, *Sri Lanka.

Rainfall depth-duration-frequency studies for Sri Lanka were carried out with data available from 19 stations spread over the country. The data are in the form of historic records of annual maximum rainfall depths with 3-, 6-, 12- and 24-h durations. The extreme-value type-1 distribution fitted with maximum likelihood estimates was utilized to derive the required relationships. The analyses for the individual stations were treated as a prelude to a regional study covering the whole country. The regions were defined, taking rainfall and topographical characteristics into consideration; and the regional data sets were formed using the station-year concept. Satisfactory results were obtained for both phases of the study. However, owing to the relatively short length of the individual station records, the regional results were recommended for use in engineering design. (Humphreys-ISWS)
W78-09349

ATMOSPHERIC SCAVENGING OF HYDROCHLORIC ACID,
Illinois Inst. of Tech. Research Inst. Chicago.
For primary bibliographic entry see Field 5A.
W78-09362

CLIMATOLOGICAL DATA FROM THE BERTHOUD PASS AREA OF COLORADO,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
For primary bibliographic entry see Field 7C.
W78-09526

A SYSTEM THAT MEASURES BLOWING SNOW,
Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO.
For primary bibliographic entry see Field 2C.
W78-09527

ARID AND SEMI-ARID LANDS: PROBLEMS AND PROSPECTS,
Cairo Univ. Giza (Egypt).
For primary bibliographic entry see Field 6G.
W78-09655

CONTRIBUTION OF DEW IN THE HYDROLOGIC BALANCE OF A SEMI-ARID GRASSLAND,
Commonwealth Scientific and Industrial Research Organization, Deniliquin (Australia). Riverina Lab.
M. L. Sharma.
Agricultural Meteorology, Vol. 17, p 321-331, 1976. 1 fig, 4 tab, 25 ref.

Descriptors: *Dew, *Hydrologic balance, *Grasslands, *Evapotranspiration, Soil water, Seasonal, Variability, Lysimeters, Precipitation(Atmospheric), Radiation, Semiarid climates, Arid lands, Australia.

Dew has long been indentified, though not generally measured, as an additional and controversial source of water supply in arid and semiarid regions. The hydrologic balance of a semiarid grassland near Deniliquin, New South Wales, was measured with a precise weighing lysimeter (1.22 x 1.53 x 1.53 m) from January through December 1974. The area was surrounded by large areas of similar grassland. Daily precipitation and open pan evaporation (Class A pan) were recorded within 400 m of the instrument, and data analyzed for quantity and duration of dew and actual evapotranspiration (ET). Dew was negligible during summer (January and February, as well as December), but amounted to 1.2% of class A evaporation, 2.5% of precipitation, or 3.9% of acutal ET for the remainder of the year. Ninety percent of the dew fell between the winter months of May and September (maximum in May-June), coinciding with the active growing period of grasslands. In June, dew amounted to 6.1% of pan evaporation, 29.8% of precipitation, or 15.6% of ET. Average monthly maximum dew duration of 17.5 hours also occurred in June. During winter, dewfall of up to 0.56mm/day was recorded. The number of dewfall days was 37 in winter, 22 in autumn, and 21 in spring. The role of dew in reducing evaporative loss of soil water is emphasized. A detailed energy budget was established in May, demonstrating that approximately 80% of net radiation was used for ET. Of this, dew used over 22%, which would have been used largely in ET of soil water. Tables show monthly dew on the grassland, and dew expressed as a percentage of ET, pan evaporation, precipitation, long term average pan evaporation, and average precipitation; monthly duration of dew; daily dew for selective months; and energy budget for May. A figure shows the daily heat budget for May. (Popkin-Arizona)
W78-09712

THE EFFECT OF CLIMATE ON IRRIGATED COTTON YIELDS UNDER SEMI-ARID CONDITIONS: TEMPERATURE-YIELD RELATIONSHIPS,
Isreal Meteorological Service, Bet-Dagan. Div. of Agricultural Meteorology.
For primary bibliographic entry see Field 3F.
W78-09717

2C. Snow, Ice, and Frost

ON THERMAL STRATIFICATION IN RESERVOIRS DURING THE WINTER SEASON,
National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
For primary bibliographic entry see Field 2H.
W78-09347

CONSTRUCTION OF FROZEN FILL DAMS IN ARCTIC COASTAL REGIONS,
For primary bibliographic entry see Field 8D.
W78-09363

PERFORMANCE, DESIGN AND OPERATION OF NORTHERN EXTENDED AERATION PLANTS,
Department of the Environment, Edmonton (Alberta). Northern Technology Center.
For primary bibliographic entry see Field 5D.
W78-09386

A SYSTEM THAT MEASURES BLOWING SNOW,
Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO.
R. A. Schmidt.
Department of Agriculture, Forest Service, Research Paper RM-194, 80 p, October, 1977. 34 fig, 4 illus, 2 append.

Descriptors: *Snow, *Particle size, *Instrumentation, *Highway icing, Snow transport, *Blowing snow, Drifting snow, Operation and maintenance, Visibility, Highways.

A snow particle counter based on a prototype design that originated at the University of Washington, was developed and tested for research in the fundamentals of snow transport by wind. Further work created an electronic system that monitors visual range in blowing snow. The system has been applied to interstate highway traffic control. All design and test data are included in this report, together with shop drawings for fabrication of the sensor, and an operating and service manual for the visual range monitor. (Witt-IPC)
W78-09527

SYMPOSIUM ON APPLIED GLACIOLOGY.
International Glaciological Society, Cambridge (England).
Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol 19, No 81, 1977. 668 p. Glen, J.W., Adie, R.J., Johnson, D.M., and Homer, D.R., editors. Published by the International Glaciological Society, Cambridge (England).

Descriptors: *Conferences, *Glaciology, *Ice, *Snow, *Avalanches, Reviews, Snowpacks, Lake ice, Sea ice, Physical properties, Ice loads, Snowpacks, Engineering, Movement, Temperature, Model studies, Hydrology, Loads(Forces), Piers, Snow cover, Glaciers, Runoff, Melt water, Glaciohydrology, Mechanical properties, Structures, Permafrost, On-site investigations, Isotope studies, Snow forces, Snow avalanches, Ice accretion, Isotope glaciology, Ice sheets, Glacier calving.

The symposium objectives were to provide a review of the present (1976) state of the art in various branches of applied glaciology and to report on recent and topical work. The invited and contributed papers covered the subject areas of snow engineering, ice engineering, avalanches, ice accretion, lake and sea ice, snow hydrology, glaciers, and ground ice. (See W76-05372 and W78-09604 thru A78-09650) (Humphreys-ISWS)
W78-09603

ENGINEERING PROPERTIES OF SNOW,
Cold Regions Research and Engineering Lab., Hanover, NH.
M. Mellor.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol 19, No 81, p 15-66, 1977. 41 fig, 2 tab, 88 ref.

Descriptors: *Snow properties, *Review, Physical properties, Mechanical properties, Thermal properties, Electrical properties, Optical properties, Density, Compressibility, Albedo, Stress, Specific heat, Diffusivity, Particle size, Temperature, Wavelengths, Heat transfer, Conductivity, Reflectance, Blowing snow, Fall velocity, Dielectric properties.

The general properties of snow were described with a view to engineering applications of data. Following an introduction and a short note on the origins of snow, data were given for fall velocities of snow particles, and for mass flux and particle concentrations in falling snow and blowing snow. Notes on the structural properties of deposited snow covered grain size, grain bonds, bulk density, overburden pressure, and permeability. A section on impurities dealt with stable and radioactive isotopes, chemical impurities, insoluble particles, living organisms, acidity, and gases. Mechanical properties were treated only selectively. The selective treatment dealt with stress waves and strain waves, compressibility, effects of volumetric strain on deviatoric strain, and specific energy for comminution. The section on thermal properties covered heat capacity, latent heat, conductivity, diffusivity, heat transfer by vapor diffusion, heat transfer and vapor transport with forced con-

vection, and thermal strain. The section on electrical properties opened with a brief discussion on dielectric properties of ice and proceeded to a summary of the dielectric loss, and d.c. conductivity. There also were notes on the thermoelectric effect on electrical charges in falling and blowing snow. The section on optical properties dealt with transmission and attenuation of visible radiation, with spectral reflectance, and with long-wave emissivity. The review concluded with some comments on engineering problems that involve snow and the requirements for research and development. (See also W78-09603) (Humphreys-ISWS)
W78-09604

SNOW FORCES,
Eidgenossisches Inst. fuer Schnee- und Lawinenforschung, Davos (Switzerland).
B. Salm.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 67-100, 1977. 19 fig, 43 ref.

Descriptors: *Snow, *Loads(Forces), *Theoretical analysis, *Model studies, Slopes, Snow cover, Movement, Creep, Stress, Mechanical properties, Compressive strength, Mathematical models, Analytical techniques, Foreign research, *Switzerland, Snow gliding, Newtonian behavior.

Snow forces are understood as forces originating from a very slow motion of the seasonal snow cover and acting on boundaries confining it. Snow forces depend on the total water-equivalent (a statistical magnitude with a certain probability of occurrence) and on mechanical characteristics of snow. The approximation of considering of snow as a Newtonian liquid fits the requirements for applications best. In this approximation, the only mechanical characteristics to be taken into account, besides density, are shear viscosity and Poisson's ratio--which depend strongly on the snow structure. Generalizations were shown in which the snow cover is subdivided into layers having constant (Newtonian) properties. Non-Newtonian behavior also was mentioned. (See also W78-09603) (Humphreys-ISWS)
W78-09605

DIRECT SIMPLE SHEAR TESTS ON SNOW AND THEIR RELATION TO SLAB AVALANCHE FORMATION,
Norwegian Geotechnical Inst., Oslo.
D. M. McClung.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 101-109, 1977. 6 fig, 1 tab, 14 ref.

Descriptors: *Snow, *Laboratory tests, *Shear stress, Testing procedures, Analysis, Movement, Avalanches, Foreign research, Deformation, Methodology, Density, *Norway, Slab avalanche.

Many slab avalanches can be attributed to shear failure in a weak, thin basal layer at the slab base. A reasonable starting point for evaluation of the conditions prior to fracture is, therefore, an investigation of shear failure in thin samples of snow. This paper gave the experimental procedure and data on measurements of shear stress versus displacement for thin samples of snow under plane strain and approximately simple shear conditions. The data were given under varying conditions of strain-rate, normal stress, density, and snow type. The results showed that the samples exhibited strain-softening provided they were sheared faster than they gained strength by settlement under the chosen conditons. If snow fails at the base of a slab in the way in which it fails in the laboratory, then a mechanism is provided whereby tensile stresses would be produced in the slab and whereby the corresponding maximum principal stresses would be rotated toward a direction parallel to the slope, thereby promoting avalanche release. (See also W78-09603) (Humphreys-ISWS)
W78-09606

A FRACTURE CRITERION FOR SNOW,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
R. L. Brown.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 111-121, 1977. 5 fig, 2 tab, 6 ref. DA-ARO-D-31-124-71-GS9, NSF GA-3943.

Descriptors: *Snow, *Failure(Mechanics), *Theoretical analysis, *Model studies, Stress, Deformation, Mathematical models, Forecasting, Tensile stress, Compressive stress, Shear stress, Analytical techniques, Laboratory tests, Analysis, Fine-grained granular snow.

A fracture criterion was developed for fine-grained granular snow and was shown to predict accurately the conditions required for fracture under multiaxial states of stress. The criterion was applied to two specific types of deformation histories. The first deformation path involves an initial high strain-rate to produce fracture from an unstressed rest configuration, and the second path involves multiple strain-rate paths. The criterion expresses the critical value of deviatoric free energy in terms of the volumetric free energy and internal energy dissipation, and it was found to predict fracture accurately for tension, compression, and shear. (See also W78-09603) (Humphreys-ISWS)
W78-09607

SNOW DRIFT,
Melbourne Univ., Parkville (Australia). Dept. of Meteorology.
U. Radok.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 123-139, 1977. 6 fig, 53 ref, 1 append.

Descriptors: *Snowpacks, *Snow management, *Glaciology, *Reviews, Theoretical analysis, Snow, Wind erosion, Aggradation, Erosion, Erosion control, Movement, Saltation, Buildings, Roads, Analytical techniques, Foreign research, Wind blown snow, Drift evaporation, Snow erosion, Drift accumulation.

Wind-blown snow represents an age-old problem in the applied glaciology of most higher-latitude regions, but its physical intricacies first received attention in esoteric discussions on the long-term mass balance of polar ice sheets. Measurements on the uniform unlimited surface of such ice sheets have shown good agreement, at least over a limited height range, with estimates for the concentration and flux of drift snow as a function of height and wind velocity based on turbulence theory. An alternative theory, developed concurrently from wind-tunnel results and field observations in Siberia, was discussed. Basic questions requiring further study include drift snow concentrations at considerable heights, drift evaporation, and electrical phenomena. The main practical aspects of snow drift relate to the prevention of excess accumulation on roads, railway lines, and avalanche slopes; and to the encouragement of accumulation in fields and forests, and other locations where frost protection and/or storage of water is desired. The methods used were reviewed; the methods are beginning to rely on physical concepts and theories rather than solely on empirical formulas derived from engineering experiments. In regions of positive surface mass balance, buildings and other structures tent to become obliterated by snow drift. An important factor of this process is the fall-out of snow in the retarded flow on the windward side of the structure. Some recent attempts to measure and calculate that fall-out were discussed. (See also W78-09603) (Humphreys-ISWS)
W78-09608

THE KINETIC FRICTION ON SNOW AND ICE,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
D. Kuroiwa.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England). September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 141-152, 1977. 10 fig. 1 tab, 13 ref.

Descriptors: *Snow, *Ice, *Friction, *Testing, Laboratory tests, On-site tests, Lake ice, Testing procedures, Movement, Velocity, Measurement, Analytical techniques, Analysis, Kinetics, Skiing, Ice skating, Foreign research, *Japan, Kinetic friction, Friction coefficient.

This paper presented many experimental data of friction between a slider and snow or ice in relation to skiing and skating. Measurements of the kinetic coefficient of friction, k, for a metallic or plastic-resin ring in contact with a snow surface were made using an oscillograph. The mechanism of this friction was analyzed through oscillograms showing frictional resistance between a slider and a snow surface together with observations of the real contact area between the surface of the slider and snow grains. It was shown that friction at low sliding speeds caused plastic deformation within snow, but, when sliding velocity was increased, a stick-slip friction occurred accompanying fractures and abrasions of snow grains. Since the laboratory experiment of friction on snow is limited to a range of low sliding speeds, the measurements of k for practical skis increased from 0.03 to 0.1 as the speed increased from velocities 5 to 22 m/s. The measurements of k for skates were made using a specially designed device on skating rinks prepared both on natural lake ice and artificial ice. The temperature dependence of k was studied for the blades of skates; k showed a minimum for both rinks around -1 to -2C, namely, 0.003 for the natural lake ice and 0.0078 for the artificial rink ice. (See also W78-09603) (Humphreys-ISWS)
W78-09609

THE MODELING AND MEASUREMENT OF THE DEFORMATION OF A SLOPING SNOW-PACK,
Montana State Univ., Bozeman. Dept. of Engineering and Mechanics.
T. E. Lang, and R. A. Sommerfeld.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium of Glaciology, Cambridge (England), September 13-17, 1976. Journa of Glaciology, Vol. 19, No. 81, p 153-163, 1977. 5 fig, 2 tab, 10 ref.

Descriptors: *Snowpacks, *Deformation, *Model studies, *On-site tests, *Colorado, Analytical techniques, Stress, Mathematical models, Measurement, Slopes, Snow management, Snow, Testing procedures, Finite element analysis, Analysis, Deformation rates.

The modeling of deformation in snowpack of realistic geometry was reproted. Experimentally measured deformation rates were compared with corresponding rates predicted from a finite-element model developed using local stratigraphy in the experimental area. Specifically designed deformation gages placed on an avalanche-sensitive snow slope at Berthoud Pass, Colorado, during the winter of 1972-73 were used to measure the experimental values. The finite-element code, based upon a plane-strain idealization, was used to model the steady-state flow of the slope. The program incorporates visco-elastic of the snowpack, snow-layer stratigraphy, and the orthotropic pro-

perties of snow when both tension and compression components of stress act at a point. The degree of correlation between experimental and computed values of deformation rates was reported, and limitations of the analysis in conjunction with the type of experimental data taken were discussed. (See also W78-09603) (Humphreys-ISWS)
W78-09610

APPROXIMATE SOLUTIONS FOR THE INTERRUPTION OF CREEP AND GLIDE BY AVALANCHE DEFENSES,
Washington Univ., Seattle. Dept. of Civil Engineering.
R. J. Evans, and J. A. Langdon.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 165-173, 1977. 7 fig, 7 ref, 1 append.

Descriptors: *Snowpacks, *Avalanches, *Theoretical analysis, *Model studies, Snow, Glaciology, Barriers, Finite element analysis, Deformation, Stress, Analysis, Velocity, Movement, Forces(Loads), Analytical techniques, Mathematical models, Avalanche defences.

A numerical calculation procedure is presented for the stress and deformation anaysis of a snow mass which is creeping and gliding on an inclined surface and which in addition, may be restrained by rigid obstacles. The analysis was based on the assumption that the velocity profile at any position in the snowpack is linear, that is, that sections initially plane remain plane during deformation. Such motion has been observed to occur in the neutral zne and is certainly true at a rigid barrier; accordingly, it appears to be reasonable to restrict the velocity field to be plane everywhere. A constitutive law for steady creep was used which is consistent with the observed neutral zone motion. The solution procedures was illustrated by its application to some problems of avalanche defense barriers. The cases investigated include: continuous barriers, cylindrical barriers, and barriers of finite width. Barrier forces and the extent of backpressure zone were given. (See also W78-09603) (Humphreys-ISWS)
W78-09611

PROGAGATION OF A PLASTIC WAVE IN SNOW,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
G. Wakahama, and A. Sato.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 175-183, 1977. 6 fig, 8 ref.

Descriptors: *Snow, *Deformation, *Laboratory tests, Movement, Plastic deformation, Celerity, Foreign research, Testing procedures, Analysis, Velocity, Evaluation, *Plastic wave.

In order to clarify the detailed processes of the deformation of snow at high rates, laboratory experiments were made by compressing snow at high speed. The propagation of a plastic wave through snow was observed by using a high-speed camera and a pressure-detecting device. Analyses of the data obtained gave the velocity of the plastic wave for various kinds of snow whose density ranged from 0.17 to 0.46 Mg/cu m and free-water content from 0 to 17%, whereby studies were made into the dependences on the density and free-water content of the velocity of the plastic wave. When the impact velocity was 4.3 + or - 0.2 m/s, the wave velocity ranged from 5 m/s for a new snow to 12 m/s for a fine-grained, well-settled snow. The plastic-wave velocity in wet snow was, in general, smaller than that in dry snow of the same density. Changes in density and structure of snow associated with the passage of a plastic wave were studied and discussed. The pressure at the wave front was measured; values of 0.1-0.3 bar were obtained, these are of the same order as the value estimated from theoretical formulas. The plastic-wave velocity also was observed for a confined snow, which showed a larger velocity and plastic strain than an unconfined snow. (See also W78-09603) (Humphreys-ISWS)
W78-09612

EXPECTED SNOW LOADS ON STRUCTURES FROM INCOMPLETE HYDROLOGICAL DATA,
Eidgenossisches Inst. fuer Schnee- und Lawinenforschung, Davos (Switzerland).
J. Martinec.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 185-195, 1977. 9 fig, 17 ref.

Descriptors: *Snow cover, *Water equivalent, *Loads(Forces), *Buildings, Snow, Building codes, Compaction, Frequency, Frequency curves, Estimating, Evaluation, Analytical techniques, Analysis, Altitude, Foreign research, *Switzerland, Snow loads, Densification.

An assessment of snow loads in Switzerland was required for a revision of the building code. Settling curves of snow were used to compute water equivalents of snow if direct measurements were not available. Based on a frequency analysis, relations between the snow load and the altitude were given for various return periods. Problems of regional effects and of converting the snow cover data to roof loads were outlined. (See also W78-09603) (Humphreys-ISWS)
W78-09613

ENGINEERING PROPERTIES OF FRESHWATER ICE,
National Research Council of Canada, Ottawa (Canada). Div. of Building Research.
L. W. Gold.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 197-212, 1977. 5 fig, 45 ref.

Descriptors: *Ice, *Mechanical properties, *Strength, *Reviews, Ice loads, Deformation, Freshwater, Ice cover, Stress, Ductility, Engineering, Shear stress, Youngs modulus, Yield strength, Tensile strength, Compressive strength, Rupturing, Strain, Freshwater ice, Crack propagation.

This review gave attention primarily to the deformation and strength behavior of ice. The principal engineering problems requiring knowledge concerning the properties of ice are prediction of the maximum force that ice might exert on a structure and determination of the load that can be placed safely on an ice cover. The properties of ice relevant to these problems were discussed. Particular attention was given to the dependence of Young's modulus on the frequency of the stress, strain-rate dependence of the yield and fracture strengths, and the ductile to brittle transition. It was shown that the strain-rate dependence of these properties is consistent with information on the stress dependence of dislocation velocity on the basal plane. The tensile and compressive strengths also were shown to be consistent with current theories of crack initiation and propagation. (See also W78-09603) (Humphreys-ISWS)
W78-09614

MEASURING THE UNIAXIAL COMPRESSIVE STRENGTH OF ICE,
Cold Regions Research and Engineering Lab., Hanover, NH.
F. D. Haynes, and M. Mellor.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 213-223, 1977. 6 fig, 3 tab, 7 ref, 1 append.

Descriptors: *Ice, *Compressive strength, *Laboratory equipment, *Testing procedures, Mechanical properties, Methodology, Laboratory tests, Equipment, Evaluation, Stress, Measurement, Youngs modulus, Strength of materials, Uniaxial compressive strength, Specimen preparation.

An attempt was made to develop a simple but accurate method for making compressive strength tests on right circular cylinders. Compliant loading platens were designed to apply uniform normal stress without introducing significant interface radial shear stresses. The compliant platens gave reproducible results that agreed well with results obtained by a precise conventional technique. Accurate results were obtained with simple specimen preparation, and with short specimens where the length-to-diameter ratio was less than unity. Platens were made from a rubber-like urethane which was molded in aluminum cylinders to provide lateral restraint. Uniaxial compression tests on cylindrical polycrystalline ice specimens were made to determine the characteristics of the platens. For 21 specimens with ends prepared on a lapping plate to obtain a mirror finish, the measured strength showed a variation of only 13% for length-to-diameter ratios from 0.74 to 2.5, with no systematic trend. Another 21 specimens with length-to-diameter ratios of about 2.35 were tested with various platens and various methods of specimen end preparation. The strength for specimens with saw-cut ends and for those with ends lapped showed very little difference when tested with the rubber platens. The main advantages gained from the use of these platens are: (1) simple procedures are adequate for specimen preparation, and (2) short lengths of core can be utilized. These advantages are of very great significance in field testing where precise technique is not always feasible and the traditional field technique gives highly inaccurate data. (See also W78-09603) (Humphreys-ISWS)
W78-09615

FRICTION OF A STEEL BALL ON A SINGLE CRYSTAL OF ICE,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
K. Tusima.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 225-235, 1977. 9 fig, 2 tab, 24 ref.

Descriptors: *Ice, *Friction, *Mechanical properties, *Laboratory tests, Kinetics, Measurement, Laboratory equipment, Testing procedures, Loads(Forces), Velocity, Steel, Temperature, Foreign research, *Friction coefficient, Kinetic friction, Brinell hardness.

Results are presented of a study carried out to explain the low friction on ice. Friction of a steel ball on a single crystal of ice was measured as a function of load, velocity, temperature, and diameter of slider. It was found that even when the velocity was very small (1.5 x 10 to the minus 7th power to 0.0018 m/s), the coefficient of friction was very small, ranging from 0.005 to 0.2, although friction on the prismatic plane was twice as large as that on the basal plane. The coefficient of friction increased with load, which means that Amonton's classical law, of friction is not applicable to ice. The coefficient of friction increased with decreasing velocity, which may result from the creep of ice in the contact area. The friction strongly increased as the temperature became close to 0C. A minimum friction was observed for a definite tem-

perature. It was found that the explanation of the results obtained is given satisfactorily neither by the classic pressure-melting theory nor by the friction-melting theory, but only by adhesion theory. (See also W78-09603) (Humphreys-ISWS)
W78-09616

CONCENTRATED LOADS ON A FLOATING ICE SHEET,
Cold Regions Research and Engineering Lab., Hanover, NH.
D. E. Nevel.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 237-245, 1977. 5 fig, 1 tab, 8 ref.

Descriptors: *Ice loads, *Stress distribution, *Mathematical models, Load distribution, Loads(Forces), Floating, Elastic theory, Mathematical studies, Mechanical properties, Stress, Analytical techniques, Theoretical analysis, Ice sheets, Rectangular loads.

The safe bearing capacity of a floating ice sheet usually is determined by limiting the maximum tensile stress which occurs under the load at the bottom of the ice sheet. If the size of the load distribution is large compared to the ice thickness, the thin plate theory predicts these stresses correctly. However, if the size of the load distribution becomes small compared to the ice thickness, the plate theory overestimates the stresses. In this case, the ice sheet should be treated as a three-dimensional elastic layer. Previous investigators have solved the elastic-layer problem for loads distributed over a circular area and have limited the results to the stress at the bottom of the ice sheet directly under the center of the load. In this paper, the stresses were evaluated at any radial position, and it was shown how these stresses approach those for the plate theory as the radial position becomes large. The solutions for the stresses were presented in integral form, as well as graphs from the numerical integration. These new results were significant for the superposition of stresses when two concentrated loads act near each other. Similarly for loads distributed over a rectangular area, the plate theory will overestimate the stresses if the dimensions of the load becomes small compared to the ice thickness. For this case, integral solutions were presented for the stresses and were evaluated directly under the center of the load. (See also W78-09603) (Humphreys-ISWS)
W78-09617

FLEXURAL STRENGTH OF ICE ON TEMPERATE LAKES,
Cold Regions Research and Engineering Lab., Hanover, NH.
A. J. Gow.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 247-256, 1977. 6 fig, 8 tab, 7 ref.

Descriptors: *Lake ice, *Beams(Structural), *New Hampshire, *On-site tests, Strength of materials, Ice, Mechanical properties, Temperature, Lakes, Structural members, Cantilevers, Testing, Testing procedures, Stress, Equipment, On-site data collections, Strength, Flexural strength, Simply supported beam.

Tests of the flexural strength of temperate lake ice were performed at two test sites in New Hampshire. Large, simply supported beams of temperate lake ice generally yield significantly higher flexural strengths than the same beams tested in the cantilever mode. Data support the view that a significant stress concentration may exist at the fixed corners of the cantilever beams. Maximum effects are experienced with beams of cold, brittle ice substantially free of structural imperfections; the stress concentration factor may exceed 2.0 in this kind of ice. In ice that has undergone extensive thermal degradation, the stress concentration effect may be eliminated entirely. Simply supported beams generally test stronger when the top surface is placed in tension. This behavior is attributed to differences in ice type--the fine-grained, crack-free top layer of snow-ice usually reacting more strongly in tension than the coarse-grained bottom lake ice which is prone to cracking. (See also W78-09603) (Humphreys-ISWS)
W78-09618

ICE FORCES,
Technical Univ. of Denmark, Lyngby (Denmark). Inst. of Hydrodynamics and Hydraulic Engineering.
P. Tryde.
In: Symposium of Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 257-264, 1977. 7 fig, 10 ref.

Descriptors: *Ice loads, *Rupturing, *Theoretical analysis, *Mathematical models, Ice, Loads(Forces), Glaciers, Floating, Analytical techniques, Distribution patterns, Rupture patterns, Ice floes, Ice sheets.

The behavior of ice-floes are considered as floating plates which rupture against obstructions of various shapes. The velocity of contact is large enough to exclude plastic deformation, and the ice is assumed to behave as an elastic material until failure. The reported research dealt essentially with ice of a constant thickness, formed in water. When large masses of ice, for example in the form of glaciers or floating ice fields, are moving against an obstruction, either natural or man-made, huge forces will develop. The paper discussed the different types of rupture patterns that may develop in front of either vertical or inclined faces, and formulas were given for some typical cases. The basic formula, derived from elementary mechanics, used to estimate the forces was written as F = (a function of the geometrical and physical parameters of the system) times (the compression strength of the ice) times (the ice thickness) times (the width of the structure). (See also W78-9603) (Humphreys-ISWS)
W78-09619

ICE-STRUCTURE INTERACTION WITH ARTIFICIALLY GENERATED FORCE RECORDS,
Memorial Univ. of Newfoundland, St. John's. Faculty of Engineering and Applied Science.
A. S. J. Swamidas, D. V. Reddy, and G. Purcell.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 265-283, 1977. 14 fig, 6 tab, 45 ref.

Descriptors: *Ice loads, *Offshore platforms, *Model studies, *Cold regions, *Alaska, Towers, Structures, Ice, Hydraulics, Theoretical analysis, Dynamics, Fluctuations, Loads(Forces), Engineering structures, Mathematical models, Analytical techniques, Statistical methods, Computer programs, Stochastic processes.

The paper described the dynamic ice-structure interaction study of monopod platforms (fixed type) which are of considerable interest to the off-shore oil industry in cold regions. In view of the scantiness of continuous ice-force records, artificial-force records were generated from available small-scale field ice-force records using stochastic concepts. The method, based on the similarity between the fluctuating parts of randomly varying ice-force records and the seismic records, uses a non-stationary random process obtained from filtering a shot noise through a second-order filter. The dynamic response analysis of a monopod structure located at Cook Inlet, Alaska was carried out by hybridizing the relevant sub-routines of the computer programmes, SAP IV (Structural Analysis Programme) and EATSW (Earthquake response of Axisymmetric Tower Structures surrounded by Water). The work included a study of the influence of soil properties on the frequencies and responses, and a comparison between the responses of fixed and elastically supported (by the soil foundation) monopod platforms. (See also W78-09603) (Humphreys-ISWS)
W78-09620

MECHANISMS AND THEORY OF IDENTATION OF ICE PLATES,
Laval Univ., Quebec. Lab. of Ice Mechanics.
B. Michel, and N. Toussaint.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 285-300, 1977. 11 fig, 4 tab, 15 ref.

Descriptors: *Ice loads, *Penetration, *Laboratory tests, *Loads(Forces), Ice, Deformation, Rates of application, Mechanical properties, Stress, Strain, Rupturing, Rates, Testing procedures, Data collections, Analysis, Analytical techniques, Ice sheets, Indentation tests.

This study gave the results and interpretation of tests made in a cold room on ice plates held vertically in a press and indented at various speeds with a rectangular indentor. These plates, 81 cm sq, were held and frozen solid to a steel frame to represent semi-infinite ice sheets. The tests were carried out at -10C, with indentation speeds varying from 0.00006 cm/s to 3 cm/s. It was found that the nominal pressure of indentation varies as a function of loading rates in a manner similar to that of the strength of S sub 2 ice in uniaxial compression. The pressure increases rapidly with loading rates up to its maximum value at a strain-rate of 0.0005/s. From there on, the pressure decreases. In the ductile range and up to the point of maximum pressure, a theoretical model was proposed where the theory of indentation of an ideal plastic body can be applied to predict an identation pressure close to three times that of the uniaxial crushing strength. The test did not show any so-called 'ratio effect' caused by the ratio of the indentor width to the plane thickness. This effect could be explained by the influence of the geometry of the indentor on the strain-rate. (See also W78-09603) (Humphreys-ISWS)
W78-09621

INDENTATION TESTS TO INVESTIGATE ICE PRESSURES ON VERTICAL PIERS,
Imperial Oil Ltd., Calgary (Alberta).
K. R. Croasdale, N. R. Morgenstern, and J. B. Nuttall.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 301-312, 1977. 11 fig, 2 tab, 9 ref.

Descriptors: *Ice loads, *Lake ice, *Piers, *Testing, Ice, Structures, Loads(Forces), Laboratory tests, On-site tests, Strength, Strain, Rates, Compressive strength, Rupturing, Data collections, Theoretical analysis, Penetration, Engineering, Equipment, Testing procedures, Mechanical properties, Analysis, Analytical techniques, Indentation tests.

Controlled field and laboratory tests were performed to investigate the relationship between ice strength and the maximum ice pressures on vertical piers. The apparatus used in the field tests consisted of a flat indentor (75 cm wide) which was pushed through the ice by hydraulic rams. Twenty-seven tests were conducted on lake ice up to 1 m thick. Ice pressures in the range 2.5 to 5.0 MPa were obtained for ice in good initial contact with

the identor. The ice pressures exhibited little sensitivity to variations in temperature, ice thickness, and strain-rate for the range 0.000075 to 0.0044/s. The average unconfined compressive strengths obtained in the laboratory were about 20% higher than the average field ice pressures. In addition, the laboratory strengths were found to be sensitive to temperature and to strain-rate in the range 1 X 10 to the minus 7th power to 0.001/s. The confined compressive strength was 2 to 3 times the unconfined strength. The failure modes observed in the identation tests were similar to those predicted (before the tests) by an upper-bound plasticity model. The ability of the model to relate small-scale ice strength to field ice pressures was discussed. The results presented in this paper should not be used by the engineer to design piers for ice-infested areas without further qualification. It is obvious that the perfect contact which was striven for in these tests would not be appropriate to most actual structures. (See also W78-09603) (Humphreys-ISWS).
W78-09622

SNOW AVALANCHES: A REVIEW OF CURRENT RESEARCH AND APPLICATIONS,
Washington Univ., Seattle. Geophysics Program; and Washington Univ., Seattle. Dept. of Atmospheric Sciences.
E. R. LaChapelle.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 313-324, 1977. 51 ref.

Descriptors: *Avalanches, *Snow, *Reviews, *Glaciology, Forecasting, Statistical mods, Mapping, Snow management, Zoning, Hazards, Land use, *Snow avalanches, Avalanche release.

Snow avalanches have long been an active area of applied glaciology. Empirical and traditional methods of forecasting and controlling avalanches are gradually giving way to the application of modern science and engineering. There are four areas of this science where progress is being made through active interaction among scientists, engineers, and practical men. The artificial release of avalanches as a control measure has seen a large body of research regarding effects of explosives on snow but still is handicapped by inadequate basic knowledge about avalanche release mechanisms. There is currently a surge of interest in testing numerical methods of avalanche forecasting, and several sophisticated statistical techniques have been introduced; but operational forecasting still depends largely on empirical experience. The pressure of development on alpine lands has brought to the fore a number of problems associated with mapping avalanches, determining their return intervals, and deducing their behavior from both observations of terrain and vegetation and calculating their behavior from theory. The ability to predict the characteristics of moving avalanches is advancing through a combination of theoretical insights and field observations, but is inhibited by the difficulty of the latter. (See also W78-09603) (Humphreys-ISWS)
W78-09623

CONTINUOUS MONITORING OF METAMORPHIC CHANGES OF INTERNAL SNOW STRUCTURE AS A TOOL IN AVALANCHE STUDIES,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
R. L. Armstrong.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 325-334, 1977. 7 fig, 11 ref.

Descriptors: *Snow, *Monitoring, *Colorado, Avalanches, Mechanical properties, Shear, Stratigraphy, Density, Profiles, Meteorology, Physical properties, Density stratification, On-site investigations, Rupturing, Temperature, Water equivalent, Snowfall, Precipitation(Atmospheric), *Snow structure, *San Juan Mountains(Colo), Snow avalanches, Slab avalanches, Metamorphosis.

Relationships between snow structure, climatic factors, and the nature of avalanche events in the San Juan Mountains of Colorado were analyzed. Physical and mechanical properties of the snow cover have been monitored on a continuous basis by conventional methods as well as through the application of a profiling snow-density gauge. Temperature-gradient metamorphism is the dominant mechanism which determines the character of the local snow structure. Properties unique to well-developed temperature-gradient snow (depth hoar) were discussed. Three specific metamorphic processes were described which contribute to a highly varied and mechanically weak snow structure. Analysis of fracture-line profile data allowed general studies of the local snow climate to be compared with the stratigraphy of actual release zones. Fracture-line data support the conclusion that meteorological conditions prevailing at the time of new-snow deposition play a less significant role in the eventual release of slab avalanches than metamorphic processes which influence the snow cover between storm periods. Shear failure zones are consistently composed of weak layers metamorphosed weeks and even months prior to the precipitation event which triggers the release. (See also W78-09603) (Humphreys-ISWS)
W78-09624

GRADIENT METAMORPHISM, ZONAL WEAKENING OF THE SNOWPACK AND AVALANCHE INITIATION,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
C. C. Bradley, R. L. Brown, and T. R. Williams.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 335-342, 1977. 9 fig, 9 ref. DA-ARO-D-31-124-71-GS9, NSF GA-3943.

Descriptors: *Snowpacks, *Mechanical properties, *Avalanches, Snow, Laboratory tests, On-site tests, Analysis, Density stratification, Temperature, Profile, Snowfall, Youngs modulus, Testing procedures, *Snow structure, *Yellowstone National Park, Avalanche release, Metamorphosis.

A co-ordinated study involving both a field investigation in Yellowstone National Park and a laboratory investigation was undertaken to evaluate the process of temperature-gradient metamorphism on the mechanical properties of snow. Both parts of the investigation showed that, when subjected to a negative temperature gradient, low-to-medium density snow metamorphoses first into a fine-grained anhedral depth hoar before finally acquiring a fully developed, and stronger, euhedral crystal structure. Measurements indicated that the subhedral snow was the weakest stage in the metamorphic process and that, while strength may drop to as low as 10% of the original strength, the material stiffness decreased by less than 50%. Also, it was observed that the location of weakest snow was usually the point of a local maximum density and largest temperature gradient, thus suggesting a relationship between metamorphic state and thermal conductivity. (See also W78-09603) (Humphreys-ISWS)
W78-09625

A MODEL STUDY OF POWDER-SNOW AVALANCHES,
Grenoble Univ. (France). Inst. of Mechanics.
E. J. Hopfinger, and J. C. Tochon-Danguy.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 343-356, 1977. 10 fig, 10 ref.

Descriptors: *Avalanches, *Snow, *Model studies, Mathematical models, Theoretical analysis, Entrainment, Density currents, Laboratory tests, Hydraulic models, Testing procedures, Air entrainment, Density stratification, Flow, Analytical techniques, Velocity, Flow characteristics, Drag, Profiles, Flow separation, Powder snow avalanches, Snow entrainment.

A powder-snow avalanche is a particular type of turbulent gravity current which it is proposed to treat using methods developed in contexts where the Boussinesq approximation is valid. Hence, it is assumed that the air entrainment rate E primarily depends on the internal Froude number (Tochon-Danguy and Hopfinger, 1975) and that the large density variation in an avalanche reduces only the drag resulting from the air entrainment. In order for this drag to dominate over the wall stress, it is necessary that the slope angle be greater than a certain minimum value which depends on the density ratio of the flow. For a low-density flow, for example, a minimum slope angle of about 5 deg is necessary. The more unusual aspect is that an avalanche also may entrain snow along its path, which increases its mass and in certain cases can produce an accelerating flow. This aspect was included in the theoretical treatment. Experiments were carried out in an inclined water channel using brine as dense fluid. Visual observations as well as measurements of the velocity and density profiles were made. Various states of flow were proposed, depending on whether the avalanche is 'long' (having the structure of a usual gravity current), or 'short' (having the structure of a thermal), or whether snow is entrained. The practical consequences which can be drawn from these results were discussed, in particular in the context of the design of defence structures, and flow visualizations of a gravity current impinging on an obstacle give an idea of the protected region. (See also W78-04029 and W78-09603) (Humphreys-ISWS)
W78-09626

ON THE FLOW OF AVALANCHING SNOW,
Eidgenossisches Inst. fuer Schnee- und Lawinenforschung, Davos (Switzerland).
M. Heimgartner.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 357-363, 1977. 6 fig, 1 tab, 9 ref.

Descriptors: *Avalanches, *Snow, *Model studies, *Analytical techniques, Mathematical models, Theoretical analysis, Analysis, Flow, Energy equation, Hydraulics, Depth, On-site investigations, Laboratory tests, Foreign research, *Snow avalanches, Flowing avalanches.

Variation of flow depth of a flowing avalanche caused by a change in the slope angle was examined using Bernoulli's energy equation, used in hydraulics to determine a non-uniform steady flow. This equation was modified for a material with internal friction and a strongly curved track. The calculated flow depth were compared with those obtained by tests with a snow slide. In the flow model dry and turbulent friction were taken into account. Friction coefficients were estimated comparing calculated and measured flow depths. It appears that in wet snow they differ from those of dry snow. This model was used to calculate the runout distance of a natural avalanche. This distance agreed well with the measured runout. (See also W78-09603) (Humphreys-ISWS)
W78-09627

WAVE PATTERN OF FLOWING SNOW SLABS,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
T. E. Lang.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 365-373, 1977. 6 fig, 4 ref.

Descriptors: *Avalanches, *Snow, *Model studies, Wavelengths, Distribution patterns, Spatial distribution, Mathematical models, Mathematical studies, Analytical techniques, Theoretical analysis, Flow, *Snow slabs.

Equations were derived, using a total potential-energy formulation, which predict the wavelength of the dominant wave pattern of a flowing snow slab. Account was taken of the visco-elastic properties of an assumed surface layer of snow which overlays a distinct visco-elastic foundation layer of snow. The predicted wave pattern is recognized as a precursory mechanism which influences the characteristics of the sawtooth flank fracture pattern that may remain following a snow avalanche, particularly on broad, uniform slopes. The parameters that influence the wave pattern were determined by an order-of-magnitude reduction of the terms in the governing differential equation for visco-elastic slab response. The major deduction from this analysis is the physical condition that the visco-elastic flow of a snow slab supported on a visco-elastic foundation has a natural tendency to form a wave pattern of wavelength dependent upon specific material properties. (See also W78-09603) (Humphreys-ISWS)
W78-09628

EVALUATION AND COMPARISON OF STATISTICAL AND CONVENTIONAL METHODS OF FORECASTING AVALANCHE HAZARD,
Eidgenossisches Inst. fuer Schnee- und Lawinenforschung, Davos (Switzerland).
P. Fohn, W. Good, P. Bois, and C. Obled.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 375-387, 1977. 8 fig, 1 tab, 10 ref.

Descriptors: *Avalanches, *Forecasting, *Statistical methods, Snowpacks, Snow, Meteorology, Hazards, Evaluation, Statistical models, Mathematical models, Analysis, Analytical techniques, Multivariate analysis.

Principal problems concerning the raw data and methodological limitations of statistical and conventional avalanche forecasting methods were summarized. The concepts of four statistical models based on multivariate data analysis were outlined. In order to give an idea of the potential and quality of the different methods, test runs over two winters were discussed, and a tentative score was established. Statistical models I and IV, together with the conventional forecast, attain a score of 70-80%, whereas statistical models II and III show a slightly poorer performance. Problems with the basic data set such as wrong timing, temporal correlation of avalanche occurrances, lack of good indices for structural instability of the snow-cover (an 'avalanche-day' is a very rudimentary avalanche variable) are at present (1976) the most important problems. Statistical methods show definite potential in backing up the memory and the decision process of forecasters; however, not being explanatory, statistical methods replace neither the qualitative reasoning of the conventional method nor the quantitative-but still lacking-physically based approach of deterministic models. (See also W78-09603) (Humphreys-ISWS)
W78-09629

ALTERNATE METHODS FOR THE ARTIFICIAL RELEASE OF SNOW AVALANCHES,
Washington Univ., Seattle. Geophysics Program; and Washington Univ., Seattle. Dept. of Atmospheric Sciences.
E. R. LaChapelle.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 389-397, 1977. 4 fig. 3 ref. WSHD Research Agreement No. Y-1637.

Descriptors: *Avalanches, *Snow management, *On-site investigations, *Snow, Vibrations, Explosions, Equipment, On-site tests, Testing procedures, Methodology, *Avalanche release, Snow avalanches, Air bags.

A series of devices were developed and tested which are designed to initiate the release of snow avalanches by mechanically disturbing or altering the snow cover. These serve as substitutes for the conventional use of high explosives and artillery projectiles. Canisters charged with an explosive mixture of gases can be fired electrically by remote control and can be recycled to fire again as needed. Air bags placed underneath the snow cover can be inflated with reasonably low pressure to disrupt and dislodge the snow cover. Energetic vibrators powered by compressed air can dislodge unstable snow under favorable circumstances. A polyethylene membrane placed on the ground surface of a steep mountainside effectively inhibits the accumulation of snow by allowing new snow to slide off as fast as it accumulates. All of these methods have led to the practical release of avalanches, but none appears to offer a universal solution to avalanche release in all circumstances. The gas exploder system is the most promising to date and is currently being installed for operational use. (See also W77-05810 and W78-09603) (Humphreys-ISWS)
W78-09630

PRELIMINARY OBSERVATIONS OF ACOUSTIC EMISSIONS PRECEDING AVALANCHES,
Rocky Mountain Forest and Range Experiment Station, Fort Collins.
R. A. Sommerfeld.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 399-409, 1977. 5 fig, 3 ref.

Descriptors: *Avalanches, *Acoustics, *On-site investigations, *Snow, Sound waves, Slope stability, Stability, Exploration, Frequency, Instrumentation, Geophones.

Three geophones were used to monitor spontaneous emissions of noise in a snowpack on an avalanche track. For the whole avalanche season, 30 Hz noise was recorded on magnetic tape and 3 Hz noise was recorded for a short period of time. Periods before and during avalanches were associated with high noise, while periods of known stability were associated with low noise. While the results presented are extremely encouraging, they do not as yet resolve the problem of the development of a reliable short-term stability predictor. Not enough events have been recorded to establish reliability. Also, the marginal character of the records leaves a basic question unanswered. (See also W78-09603) (Humphreys-ISWS)
W78-09631

SPONTANEOUS FRACTURE INITIATION IN MOUNTAIN SNOW-PACKS,
Montana State Univ., Bozeman. Dept. of Earth Sciences.
W. St. Lawrence, and C. Bradley.
In: Symposium on Applied Glaciology; Proceeding of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 411-417, 1977. 3 fig, 4 ref. NSF DES 73-00233AOI, DAAG29-76-G-0037, Co-op No. 12-11-204-12.

Descriptors: *Avalanches, *Snowpacks, *Seismic studies, *On-site investigations, Glaciers, Snow, Monitoring, Instrumentation, Seismic waves, Sound waves, Frequency, Slope stability, Cracks, Rupturing, Geophones.

Over the past few years an investigation has been conducted to determine the extent of seismic signals associated with avalanching snow slopes. A number of the signals recorded were examined and classified according to their origin. One of these signals, however, is not defined clearly in terms of an observable source mechanism. To obtain information regarding the origin of this signal, results were compared from several investigations conducted to study the seismic activity associated with glaciers. A comparative analysis of the snow and glacier signals indicated that the high-frequency signals observed in snow fields are due to internal fracture within the snow. (See also W78-09603) (Humphreys-ISWS)
W78-09632

ARTIFICIAL RELEASE OF AVALANCHES BY EXPLOSIVES,
Eidgenossisches Inst. fuer Schnee- und Lawinenforschung, Davos (Switzerland).
H. Gubler.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 419-429, 1977. 6 fig, 3 tab, 6 ref.

Descriptors: *Avalanches, *Snow management, *Snow, *On-site investigations, Instrumentation, Snow cover, Explosives, Stress, Acoustics, Slope stability, Testing procedures, Seismic waves, Rupturing, Cracks, Avalanche release.

The method of the artificial release of slab avalanches by explosives was investigated. The effect of a detonation on a seasonal snow cover was measured and discussed. The attenuation of the resulting stress waves as a function of the type of explosive used, the position of the charge relative to the snow surface, the charge mass, the snow-stratification profile, and the type of ground were determined in field experiments. The effective ranges of shots in potential fracture zones were established. (See also W78-09603) (Humphreys-ISWS)
W78-09633

THE DYNAMICS OF AVALANCHING IN THE KHIBINS,
Akademiya Nauk SSSR, Moscow. Inst. Geografii.
V. M. Kotlyakov, B. N. Rzhevskiy, and V. A. Samoylov.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 431-439, 1977. 6 fig, 12 ref.

Descriptors: *Avalanches, *On-site investigations, *Snow, *Loads(Forces), Dynamics, Measurement, Velocity, Structures, On-site tests, Analytical techniques, Analysis, Foreign research, Foreign countries, Surveys, Instrumentation, Barriers, *USSR, *Khibin(USSR), Avalanche impact.

Results of ten-year measurements of avalanche impact upon a large-size installation were shown. The installation is equipped with 20 pressure sensors using the principle of the intrusion of a steel cone into a duralumin plate. The impacts of 30 dry avalanches with volumes from 100 up to 50,000 cu m were analyzed. A maximum pressure at 'a point' of 100 kN/sq m and a pressure of 650 kN/sq m averaged over the area of the installation (24 sq m)

were recorded. It was found that 75% of the impact energy is concentrated in the lowest 2 m of the installation. Proceeding from these data, and also taking into account that the thickness of an avalanche body amounts to 10-20 m at the moment of impact, it was concluded that there is a 'dense core' and an upper 'high aerosol' part in an avalanche body. The use of stereo-photogrammetric surveys of moving avalanches revealed the 'velocity depression' effect in the Khibin avalanches: Avalanche velocity decreases abruptly (by a factor 1.5 to 2) at the end of transit channel and then grows rapidly up to a maximumk at the end of the avalanche cone. The greatest variations of velocity amount to 51 m/s. The data obtained prove the inefficiency of anti-avalanche filling dams, especially because of their negative role in the generation of disasterous air waves, whose pressure varies from 20 up to 150 kN/sq m. (See also W78-09603) (Humphreys-ISWS)
W78-09634

STRONG SNOW-STORMS, THEIR EFFECT ON SNOW COVER AND SNOW ACCUMULATION,
Institut Inzhenerov Zheleznodorozhnogo Transporta, Novosibirsk (USSR). Dept. of Railroad Construction.
A. K. Dyunin, B. A. Anfilofiyev, M. G. Istrapilovich, Ya. D. Kvon, and N. T. Mamoyeva.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 441-449, 1977. 4 fig, 10 ref.

Descriptors: *Snowfall, *Model studies, *Storms, *Snowpacks, Snow, Snow cover, Laboratory tests, Laboratory equipment, Theoretical analysis, Analysis, Mathematical models, Diffusion, Flow, Winds, Wind velocity, Foreign research, *USSR, Snowstorms, Wind tunnel.

Snowdrifts have been studied by many researchers, both in field and laboratory conditions; however, these investigations have been carried out mostly at wind speeds up to 20 m/s, whereas in many areas of our planet snowstorms occur at winds up to 40 m/s and more. During the winter seasons of 1972-76, a great number of experiments with an artificial snowstorm in a special wind tunnel 27 m long were carried out. The wind speeds reached 40 m/s (60-65 m/s at the 10 m anemometer height). The existing theories and hypotheses of snowdrifting, and in particular the 'diffusion' model, were tested in a series of experiments. These experiments have not confirmed the assumption of the Australian scientists on the decisive role of diffusion in drift mechanism at large wind speeds. The problem of strong snowstorm effect on snow accumulation on avalanche-danger slopes, in particular, wind redistribution of snow, is no less important. The results obtained may be used for the determination of snow accumulation in avalanche starting zones due to deflation. This is especially important for forecasting very dangerous and frequently-occurring avalanches due to snowstorms. The investigations performed enabled the authors to estimate the snow deposition produced by strong and superstrong snowstorms, to account for the peculiarities of such snowstorms and the means of protection, to forecast snow distribution in mountainous regions, and to define the role of snowstorms in glacier mass balance. (See also W78-09603) (Humphreys-ISWS)
W78-09635

ICE ACCRETIONS ON STRUCTURES,
Toronto Univ. (Ontario). Dept. of physics.
R. List.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 451-465, 1977. 12 fig, 1 tab, 20 ref.

Descriptors: *Ice, *Growth rates, *Laboratory tests, *Drops(Fluids), Heat balance, Evaporation, Mathematical models, Analysis, Foreign research, Structures, Freezing, Water loss, Icing, Ice accretion, Water content.

Three basic areas of ice accretion were discussed: (1) the motion of the (supercooled) droplets in air up to collision with the icing object, (2) the net growth rates, and (3) the heat balance of an icing cylinder. The weakness of presently used approaches to establish collision efficiency and possible improvements were outlined. Experimental evidence on the icing of cylinders was then reviewed. The evidence established that the growth rates by icing are far less than expected because up to 80% and more of the initially accreted water can bounce off or be lost by shedding at air temperatures of -20C. The reduced growth rates have a considerable effect on the heat balance of the icing object, whose temperature and water-phase mixture are controlled by the temperature and phase of the lost water-substance. These latter properties are completely unknown and require further studies. In conclusion, the scientific aspects of icing are far from being understood; empirical findings may have to provide guidance for applications. (See also W78-09603) (Humphreys-ISWS)
W78-09636

DE-ICING OF RADOMES AND LOCK WALLS USING PNEUMATIC DEVICES,
Cold Regions Research and Engineering Lab., Hanover, NH.
S. F. Ackley, K. Itagaki, and M. D. Frank.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, 1977. 10 fig, 1 tab, 1 ref.

Descriptors: *Ice, *Deicers, *Ice breakup, *Engineering structures, Locks, Hydraulic structures, Equipment, On-site tests, Analysis, Rupturing, Methodology, Locks, Mechanical equipment, Ice accretion, Deicing, Radomes, Pneumatic devices.

A rough comparison between thermal and mechanical methods of de-icing indicated that mechanical methods could potentially de-ice with an order-of-magnitude less energy than that required to melt an ice accretion. Two applications of mechanical de-icing using pneumatically driven inflatable de-icers were described. The first of these was the de-icing of a small cylindrical radome used for air navigational purposes. Two seasons of testing were conducted with a de-icer consisting of an inflatable-deflatable flexible plastic covering. The de-icer was driven by tanks with pressure and vacuum reservoirs that were recharged by an on-site air compressor in response to a pressure sensor. The de-icing cycle was activated by an ice detector, so the system responded to icing events on a demand basis driven by the ice detector. The system proved successful in keeping the radome free of ice without manned operation and with small energy consumption in a mountain icing environment. The second application was an attempt to de-ice the walls of locks used in river nagivational facilities. Ice usually formed at the high-water-mark by the freezing of the water exposed to low air temperatures or by the pressing of ice against the walls by ships using the locks. The de-icers consisted of air-driven hoses mounted on the wall covered by a thick flexible rubber mat and protected from ship damage by steel outer plates. This method was successful in removing ice accumulations up to 2 m long by 0.3 m thick over the area covered by the de-icer. Installation costs and the necessity for protection of the de-icer against abrasion by ships may make this de-icing method prohibitively expensive compared with methods which are not as susceptible to damage by ships (e.g., chemical coatings and electrical heating cables buried in the walls). (See also W78-09603) (Humphreys-ISWS)
W78-09637

SNOW ACCRETION ON ELECTRIC WIRES AND ITS PREVENTION,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
G. Wakahama, D. Kuroiwa, and K. Gota.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 479-487, 1977. 4 fig, 1 tab, 4 ref.

Descriptors: *Snow, *Engineering structures, *Snow management, Transmission lines, Snow removal, Growth rates, Laboratory tests, Freezing, On-site investigations, Transmission towers, Analysis, Physical properties, Wind velocity, Adhesion, Foreign research, *Japan, Snow accretion, Snow structure.

This paper presented a study on the accretion of wet snowflakes transported by a strong cyclone on electric wires by means of wind-tunnel experiments and field observations, with the aim of successfully preventing them from accreting on and causing damage to power lines and high-voltage power transmission towers in snow areas in such countries as Japan, Canada, and the U.S.A. Although extensive studies have been made on snow accretion in Japan since the 1930's by many workers, their studies have been restricted to the coastal regions of central Honshu facing the Sea of Japan, which are typified by heavy wet snowfalls on the monsoon type in a weak wind of less than 3 m/s at a temperature between -1 and +1.5C continuing throughout the day. However, it has long been known that a cyclone characterized by a strong wind exceeding 10 m/s that carries heavier and wetter snowflakes can cause snow accretion on electric wires to grow to 20-30 cm in diameter. Because its detailed snow accretion processes and mechanism had not been clarified, studies were done on the growth processes of snow accretion, the adhesive stress of snow to a wire, the structure and texture of the accreted snow, coefficients of collision and collection of snow on the wire, and trajectories of individual snow particles impinging on or passing by a wire at various wind speeds. It was confirmed that wet snow can accrete on wires at any wind speed between 0 and 20 m/s. Moreover, new techniques were developed to prevent wet snow from accreting on wires, and these have proved to be effective in situ for any type of snow accretion in Hokkaido. (See also W78-09603)(Humphreys-ISWS)
W78-09638

THE INTENSITY OF DIFFERENT KINDS OF RIME ON THE UPPER TREE LINE IN THE SUDETY MOUNTAINS,
Wroclaw Univ. (Poland). Dept. of Geography.
S. Baranowski, and J. Liebersbach.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 489-497, 1977. 7 fig, 1 tab, 15 ref.

Descriptors: *Rime, *Ice, *On-site investigations, Mountains, Weather, Wind velocity, Air temperature, Weather patterns, Air circulation, Foreign research, Climatology, *Poland, *Sudety Mountains(Poland), Ice accretion.

Based on many years of measurements and observations on the frequency and intensity of deposition of various types of rime which have been conducted by the Department of Meteorology and Climatology of Wroclaw University at the top of Szrenica, Sudety mountains, a hundred meters above the tree line, the essential factors influencing this feature were determined. The upper parts of the Sudety mountains belong to the regions with the most frequent and heaviest rime deposits in Europe, which often appears to be hazardous to

farming. It has been found that intensity of rime deposition depends clearly on air temperature and wind velocity, and it is related to certain types of weather situations characterized by types of atmospheric circulation. (See also W78-09603) (Humphreys-ISWS)
W78-09639

ENGINEERING PROPERTIES OF SEA ICE,
Hamburgische Schiffbau-Versuchsanstalt (West Germany).
J. Schwarz, and W. F. Weeks.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 499-531, 1977. 18 fig, 2 tab, 109 ref.

Descriptors: *Sea ice, *Mechanical properties, *Reviews, *Ice, Engineering, Strength, Structures, Offshore platforms, Salinity, Temperature, Elasticity(Mechanical), Poisson ratio, Friction, Adhesion, Tensile strength, Compressive strength, Shear strength, Thermal properties, Ice structures, Flexural strength, Electromagnetic properties.

As the continental shelves of the Arctic become important as source areas for the oil and minerals required by human society, sea ice becomes an increasing challenge to engineers. This paper started with a consideration of the different fields of engineering which require information on sea ice with the tasks ranging from the design of ice-breaking ships to Arctic drilling platforms and man-made ice islands. Then the structure of sea ice was described as it influences the observed variations in physical properties. Next, the status of knowledge of the physical properties important to engineering was reviewed. Properties discussed included mechanical properties (compressive, tensile, shear and flexural strengths; dynamic and static elastic moduli; Poisson's ratio), friction and adhesion, thermal properties (specific and latent heats, thermal conductivity and diffusivity, density) and finally electromagnetic properties (dielectric permittivity and loss, resistivity). Particular attention was given to parameters such as temperature, strain-rate, brine volume, and loading direction as they affect property variations. Gaps, contradictions in the data, and inadequacies in testing techniques were pointed out. Suggestions were made for future research, especially for more basic laboratory studies designed to provide the data base upon which further theoretical developments as well as field studies can be built. (See also W78-09603) (Humphreys-ISWS)
W78-09640

STUDIES OF THE MOVEMENT OF COASTAL SEA ICE NEAR PRUDHOE BAY, ALASKA, U.S.A.,
Cold Regions Research and Engineering Lab., Hanover, NH.
W. F. Weeks, A. Kovacs, S. J. Mock, W. D. Tucker, and W. D. Hibler.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 533-546, 1977. 8 fig, 2 tab, 5 ref.

Descriptors: *Sea ice, *Alaska, *Coasts, *Tracking techniques, Movement, On-site investigations, Measurements, Testing procedures, Equipment, On-site tests, Air temperature, Wind velocity, Radar, Analysis, Analytical techniques, *Prudhoe Bay(Alaska).

During March-May 1976, a combination of laser and radar ranging systems was used to study the motion of both the fast ice and the pack ice near Narwhal and Cross Islands, two barrie islands located 16 and 21 km offshore in the vicinity of Prudhoe Bay, Alaska. Laser measurements of targets on the fast ice near Narwhal Island indicated small net displacements of approximately 1 m over the period of study (71 d), with short-term displacements of up to 40 cm occurring over 3 d periods. The main motion was outward normal to the coast and was believed to be the result of thermal expansion of the ice. The radar records of fast-ice sites farther offshore showed a systematic increase in the standard deviation of the displacements as measured parallel to the coast, reaching a value of + or -6.6 m at 31 km. The farthest fast-ice sites show short-term displacements of up to 12 m. There are also trends in the records that are believed to be the result of the general warming of the fast ice with time. Radar targets located on the pack ice showed large short-term displacements (up to 2.7 km) but negligible net ice drift along the coast. There was no significant correlation between the movement of the pack and the local wind, suggesting that coastal ice prediction models can succeed only if handled as part of a regional model which incorporates stress transfer through the pack. The apparent fast-ice-pack-ice boundary in the study area was located in 30-35 m of water. (See also W78-09603) (Humphreys-ISWS)
W78-09641

HORIZONTAL MOVEMENT OF FAST ICE IN THE NORTH WATER AREA,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Geographisches Inst.
H. Ito, and F. Muller.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 547-554, 1977. 6 fig, 4 ref.

Descriptors: *Sea ice, *Surveys, *Cold regions, *Arctic, Ice, Movement, Measurement, On-site investigations, Methodology, Analysis, Evaluation, Sea water, *Ellesmere Island, *Greenland, Polynya.

The understanding of the horizontal movement of fast ice is important for applied sea-ice mechanics. A case study, carried out in conjunction with a polynya known as North Water, was presented. The displacements of the fast-ice arches which separate the polynya from the surrounding ice-covered sea, were measured and found to be small. Therefore, it is, confirmed that these arches prevent the influx of large quantities of sea ice into the polynya. The rate of displacement is determined by wind, current, and boundary conditions. Two zones with different stress situations producing different displacements were noticed. Large structural features, e.g., the ridged zone, may have to be considered as the boundary condition for the analysis instead of the coast line. Once cracks appear in the area, the displacement may contain both rigid-body movement and deformation. (See also W78-09603) (Humphreys-ISWS)
W78-09642

THE FLEXURAL MOTIONS OF A FLOATING ICE SHEET INDUCED BY MOVING VEHICLES,
Saskatchewan Research Council, Saskatoon.
D. Eyre.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 555-570, 1977. 10 fig, 9 ref.

Descriptors: *Lake ice, *Lakes, *Trafficability, *Canada, Iced lakes, On-site tests, Floating, Deflection, Instrumentation, Freshwater, Testing procedure, Fluctuations, Theoretical analysis, Analytical techniques, Frequency, Movement, Velocity, Waves(Water), Transportation, Acoustics, Sound waves, Rupturing, Analysis, Foreign research, Bridges, *Lake Diefanbaker(Canada), Ice crossing, Flexural motions, Vehicle speed, Ice waves.

An extensive series of tests were conducted on a floating ice sheet on a deep, freshwater lake. A variety of vehicles were driven along an instrumented test track at a wide range of speeds, producing several characteristic patterns of ice and water response that were recorded and analyzed in detail. Tests were repeated at different stages of ice growth to accommodate changes in physical conditions. The use of a vibration transducer and a new type of deflectometer has permitted the study of many primary and secondary effects. As vehicle speed is increased, the ice and water pass through four characteristic modes of response, culminating in a wave effect at the higher speeds. It has been shown that the ice and water waves travel consistently at the speed of the vehicle. This factor was used to modify a simple ice-wave theory, which then predicts a linear variation of wave frequency with vehicle speed that can be expressed in a universal form for deep-water conditions. The experimental measurements of frequency confirmed this universal variation. The observed secondary effects include air-coupled flexural oscillations, hydrodynamic fluctuations, and systematic variations in ice fracture intensity with vehicle speed. This last effect leads to the proposition of a new criterion of vehicle safety. (See also W78-09603) (Humphreys-ISWS)
W78-09643

EXPERIENCE WITH GLACIER CALVING AND AIR-BUBBLING IN HIGH ALPINE WATER RESERVOIRS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydrologie und Glaziologie.
W. Haeberli.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposiunm on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 10, No. 81, p 589-594, 1977. 2 fig, 18 ref.

Descriptors: *Lakes, *Glaciology, *Alpine, *Ice, Water resources, Waves(Water), Glaciers, Ice breakup, On-site investigations, Ice cover, Flood protection, Hydroelectric plants, Water temperature, Foreign research, *Switzerland, Glacier calving.

Some observations which pertain to the interaction of ice and lake water in a high alpine environment and which were made in recent years in connection with hydroelectric projects and flood protection work were presented. In 1966, when the thin flat snout of Griesgletscher (Walliser Alpen) became submerged during the first filling of a newly constructed reservoir, waves of only very small amplitude were generated by the calving of about 150,000 cu m of ice because most of the energy was dissipated by local turbulence. Far more spectacular waves have been experienced near steep ice cliffs in connection with work for flood control. For the design of an air bubbler system, air and water temperatures were measured in winter 1974-75 at Grimselsee, one of the largest reservoirs in the Bernese Alps. These measurements showed that the warmest water at the bottom of the lake was drained away during winter for the production of electricity. A strong temperature inversion forms in the air above the water behind the dam, as the lake level is lowered by several tens of metres. (See also W78-09603) (Humphreys-ISWS)
W78-09644

SHORT-TERM FORECASTING OF WATER RUN-OFF FROM SNOW AND ICE,
Cold Regions Research and Engineering Lab., Hanover, NH.
S. C. Colbeck.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 571-588, 1977. 6 fig, 61 ref. 4A161102 AT24/A1/001,1F161102B52A/02/009.

Descriptors: *Runoff forecasting, *Snow, *Ice, *Reviews, *Hydrologic aspects, Forecasting, Glaciers, Snow cover, Runoff, Hydrology, Hydrographs, Water sources, Hydrologic systems, Flow, Melt water, Mathematical models, Stochastic processes, Metamorphism, Wet snow.

Accurate forecasting of water run-off from snow covers and glaciers is increasingly important because of the increasing competition for scarce water resources. The trend toward conceptual computerized models of hydrologic systems requires extensive knowledge of the physical aspects of those systems. Unlike river and stream networks, the hydrological characteristics of snow covers and glaciers are highly variable with time and cannot be easily defined. After reviewing the physical aspects of water flow through snow covers and glaciers, it was concluded that snow covers and glaciers are predictable hydrological systems once the melt metamorphism of the snow is complete and the englacial conduits have been established. However, much additional information about snow and ice masses must be generated before general forecasting techniques can be established for all situations. (See also W78-09603) (Humphreys-ISWS)
W78-09645

MOVEMENT OF A LARGE ICE MASS BEFORE BREAKING OFF,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Versuchsanstalt fuer Wasserbau, Hydeologie und Glaziologie.
A. Iken.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambride (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 595-605, 1977. 7 fig, 13 ref.

Descriptors: *Glaciers, *Lakes, *Ice breakup, *Failure(Mechanics), Glaciology, Ice, Rupturing, Flow, Model studies, Mathematical models, Theoretical analysis, Analytical techniques, Stress analysis, Cracks, On-site investigations, Movement, Foreign research, *Switzerland, Glacier calving.

In a two-dimensional model of an ice mass breaking off from a cliff, stresses and velocities were calculated numerically according to Glen's flow law. A tensile crack opens in the zone of maximum tensile principal stress sigma and propagates to a depth where sigma is zero. Ice flow then produces an overhang of the partly detached ice mass. Consequently, the stress sigma below the tip of the crack becomes tensile again and the crack propagates for another small distance. This process goes on until the center of gravity of the detaching ice mass has moved past the supporting edge of the bedrock. (See also W78-09603) (Humphreys-ISWS)
W78-09646

THE DISPOSAL OF RADIOACTIVE WASTE IN ICE SHEETS,
For primary bibliographic entry see Field 5E.
W78-09647

FRAZIL-ICE NUCLEATION BY MASS-EXCHANGE PROCESSES AT THE AIR-WATER INTERFACE,
Alaska Univ., College. Geophysical Inst.
T. E. Osterkamp.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Jounral of Glaciology, Vol. 19, No. 81, p 619-625, 1977. 34 ref. NSF GA-30748.

Descriptors: *Frazil ice, *Nucleation, *Reviews, Boundary processes, Mass transfer, Ice, Air-water interfaces, Streams, Rivers, Open channels, Slush, Freezing, Mass exchange.

The physical requirements for proposed frazil-ice nucleation theories were reviewed in the light of recent observations on frazil-ice formation. It was concluded that spontaneous heterogeneous nucleation in a thin supercooled surface layer of water is not a viable mechanism for frazil-ice nucleation. Efforts to observe crystal multiplication by border ice have not been successful. The mass-exchange mechanism proposed by Osterkamp and others (1974) was generalized to include splashing, wind spray, bubble bursting, evaporation, and material that originates at a distance from the stream (e.g., snow, frost, ice particles, cold organic material, and cold soil particles). It was shown that these mass-exchange processes can account for frazil-ice nucleation under a wide range of physical and meteorological conditions. It was suggested that secondary nucleation may be responsible for large frazil-ice concentrations in streams and rives. (See also W78-09603) (Humphrey-ISWS)
W78-09648

SUB-SEA PERMAFROST REGIME AT PRUDHOE BAY, ALASKA, U.S.A.,
Alaska Univ., College. Geophysical Inst.
T. E. Osterkamp, and W. D. Harrison.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 627-637, 1977. 7 fig, 3 tab, 14 ref.

Descriptors: *Permafrost, *Alaska, *Coasts, *Subsurface investigations, Drilling, Boreholes, Lithologic logs, Sampling, Moisture content, On-site investigations, Salts, Exploration, Conductivity, Electrical conductance, Temperature, Chemical analysis, On-site data collections, *Prudhoe Bay(Alaska).

A sub-sea permafrost drilling program was conducted near Prudhoe Bay, Alaska. Sub-sea permafrost was found at all offshore drill sites and was characterized as being ice bonded or unbonded. The unbonded sub-sea permafrost occurred in a thin layer at the sea bed; the near-shore thickness of this layer appears to be controlled by the bathymetry. The mean annual sea-bed temperatures were about -3.4C at 203 m offshore -1.1C at 481 m offshore and -0.7C at 3,370 m offshore. The thermal diffusivity was about 21 sq m/a for unbonded sandy gravel with silt. The sub-sea permafrost soils were sandy gravel with some silt overlain by a thin layer of silty sand which increased in thickness from a few meters near shore to about 14 m at 3,370 m offshore. A few small ice lenses were found in a hole 195 m offshore, but no massive ice was observed. Pore-water salt concentrations at the sea bed were 3-4 times that of normal seawater where ice was frozen to the sea bed and 1-2 times that of normal seawater otherwise. Preliminary laboratory experiments showed that the saturated hydraulic conductivity of the unbonded sub-sea permafrost was about 0.000001 to 10 to the minus 7th power m/s. The permeability of the subterrancan permafrost was zero. (See also W78-09603) (Humphreys-ISWS)
W78-09649

TOURISM, SUMMER SKI-ING, HYDROELECTRICITY AND PROTECTION OF THE PUBLIC IN THE FRENCH ALPINE GLACIAL AREA: THE DEVELOPMENT OF AN APPLIED GLACIOLOGY,
Grenoble-1 Univ. (France). Inst. de Geographic Alpine.
R. Vivian.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 639-642, 1977.

Descriptors: *Glaciology, *Alpine, *Resources development, Water resources, Glaciers, Recreation, Skiing, Ice, Water supply, Drainage, Foreign countries, Structures, *France, Subglacial drainage.

A historical review is presented of applied glaciology problems in the French Alps since the last century (cog railway to the top of Mont Blanc, construction of mountain huts, preventive emptying of subglacial water pockets under Tete Rousse glacier, etc.). The second part was devoted to a brief review of modern projects concerned with construction of cableway stations or cableway pylons on or near the glaciers, with the preparation of ski runs on glaciers during summer, and with the different problems met during works to capture subglacial torrents for the needs of hydroelectric companies. (See also W78-09603) (Humphreys-ISWS)
W78-09650

2D. Evaporation and Transpiration

EVAPORATION AND RADIATION MEASUREMENTS AT SALTON SEA, CALIFORNIA,
Geological Survey, Bay St. Louis, MS. Water Resources Div.
A. M. Sturrock, Jr.
Available from Supt. of Documents, GPO, Washington, DC 20402; Price, $1.30. Water-Supply Paper 2053, 1978. 26 p, 4 fig, 8 tab, 11 ref.

Descriptors: *Saline lakes, *Evaporation, *Solar radiation, *Energy budget, *Mass transfer, Hydrologic budget, Measurement, Analytical techniques, California, *Salton Sea(Calif).

Evaporation from Salton Sea, Calif. was computed for a 539-day period between July 14, 1967, and January 2, 1969, by use of energy-budget, mass-transfer, and water-budget methods. The total evaporation computed by the three methods agreed within 5 percent. For computing evaporation by the mass-transfer method, vapor pressure measured at raft stations on the sea was considered to be more representative of the conditions over the sea than vapor pressure measured at land stations. The values of heat transfer to and from the bed were used in energy-budget computations. The inclusion of these heat transfer values improved the correlation of evaporation computed by the energy-budget and water-budget methods. Monthly evaporation computed by the energy-budget method for 1968 showed that the Salton Sea exhibited a double-wave evaporation similar to that of oceans in the same latitude. The net incoming radiation was measured at three stations around the Salton Sea. The areal variaton was less than 1 percent on an annual basis and the largest weekly variation was less than 6 percent. (Woodard-USGS)
W78-09322

A MODEL FOR THE WATER REGIME OF CONIFEROUS FOREST AND GRASSLAND,
Swiss Forestry Research Inst., Birmensdorf (Switzerland).
H. Item.
Journal of Hydrology, Vol. 37, No. 3/4, p 323-332, May 1978. 7 fig, 1 tab, 8 ref.

Descriptors: *Water balance, *Model studies, *On-site tests, *Coniferous forests, *Grasslands, Hydrologic cycle, *Evaporanspiration, Soil water, Moisture content, Saturated soils, Transpiration, Vegetation, Forests, Mathematical models, Foreign research, *Switzerland.

In a previous investigation a functional model for the interrelations between evapotranspiration, weather conditions, and soil water content in the root zone was established and adapted to a deciduous forest. Based on results of field plot experiments by Germann, this model was adapted to a coniferous forest and a meadow. Estimation of the free model parameters for each plot leads to a

satisfactory approach to measured values of water consumption. The potential evapotranspiration of vegetation (on water saturated soil) amounts to about 1.5 times the evaporation of an open water surface under identical meteorological conditions. In both plots, transpiration reacts very sensitively to desiccation of the soil. On warm and dry summer days there is a remarkable reduction of transpiration as soon as average soil suctions in the root zone exceed previous investigation by the present author. Application of the model is still limited at the moment. It may be used only for areas where parameters are expected to be the same as for a site already investigated or where enough field measurements have been made to permit an estimation of the free parameters. (Humphreys-ISWS)
W78-09353

CLASS A PAN EVAPORATION AS AFFECTED BY SHELTER, AND A DAILY PREDICTION EQUATION,
Agricultural Research Service, Boise, ID. Northwest Watershed Research Center.
C. L. Hanson, and F. Rauzi.
Agricultural Meteorology, Vol. 18, p 27-35, 1977. 4 tab, 2 fig, 21 ref.

Descriptors: *Evaporation, *Evaporation pans, *Hydrologic data, *Hydrologic cycle, *Radiation, Shelterbelt, Great Plains, Air temperature, Wind velocity, Arid lands.

Evaporation, particularly in arid and semiarid lands, is an important factor in the hydrologic cycle and in ecohydrologic models. Class A pan evaporation is the standard method of evaporation measurement. Pan data at tree shelterbelt sites on the Northern Great Plains indicate that evaporation from pans protected from the wind was about 14 percent less than from unprotected pans. An empirical equation was developed for estimating daily Class A pan evaporation from either protected or unprotected areas. The equation is: $E=R(-0.06 + 0.036T) + 0.016W$, where E= daily Class A pan evaporation (mm/day), R = daily incident short-wave radiation in evaporation units, T = mean daily temperature (degree C), and W = total daily wind run (Km/day). It is recommended that the location of all published evaporation pan data should be investigated before using it as an index. (Popkin-Arizona)
W78-09716

WATER LOSS FROM CUT HERBAGE IN THE WINDROW AND FROM ISOLATED LEAVES AND STEMS,
Reading Univ. (England). Dept. of Agricultural Botany.
D. R. Firth, and Y. Leshem.
Agricultural Meteorology, Vol. 17, p 261-269, 1976. 4 fig, 1 tab, 6 ref.

Descriptors: *Water loss, *Leaves, *Stemflow, *Evapotranspiration, *Consumptive use, Model studies, Computer models, Flow resistance, Vetch, Grasses, Arid lands, Cut herbage, Water potential, Israel.

Pathways of water loss from cut grass are reviewed from a drying perspective, and related to atmospheric water potential. The loss of water from well ventilated single leaves and stems in laboratory tests declined exponentially, consistent with a simple biophysical and physiological model. Loss of water from vetch in the swath (or mowed strips) in an Israeli field was measured at three depths and two treatments, and was found to be more complicated. This indicates that the swath is nothing like a single uniform compartment. Total water loss was compared with pan evaporation in the field vetch experiment. Treatments which produced chopped and lacerated crop pieces, and mowed crops yielded similar water loss to pan evaporation relations. In both cases, water loss was initially somewhat greater than pan evaporation, though decreasing over time. The theoretical framework for water loss from cut herbage differs from that from a standing crop in two significant ways: that from a leaf water potential is far from that of a free water surface; and, the water lost is all stored water, which has a capacitance effect in the cleared swath. This study has implications to facilitate forage drying for high quality hay in barn or field conditions. Figures show drying curves, effects of segment length on drying, water loss of chopped and cut vetch, in relation to pan evaporation, and water loss in field vetch at three depths. Drying constants of treated isolated leaves and stems are tabulated. (Popkin-Arizona)
W78-09720

A MONTE-CARLO MODEL FOR THE RADIATION FIELD IN PLANT CANOPIES,
Technion - Israel Inst. of Tech., Haifa. Lowdermilk Faculty of Agricultural Engineering.
For primary bibliographic entry see Field 2I.
W78-09721

IMPROVING WATER USE IN SPRINKLING FOR BLOOM DELAY,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W78-09778

2E. Streamflow and Runoff

FLOOD PROFILES OF THE ALAFIA RIVER, WEST-CENTRAL FLORIDA, COMPUTED BY STEP-BACKWATER METHOD,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4A.
W78-09308

ESTIMATING RECHARGE FOR EPHEMERAL STREAMS IN ARID REGIONS: A CASE STUDY AT KAIROUAN, TUNISIA,
Ecole Nationale Superieure Des Mines de Paris, Fontainebleau (France). Center for Geological Information.
For primary bibliographic entry see Field 2F.
W78-09344

SENSITIVITY OF OPTIMIZED PARAMETERS IN WATERSHED MODELS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W78-09345

UNBIASED PLOTTING POSITIONS-A REVIEW,
Ireland Office of Public Works, Dublin.
For primary bibliographic entry see Field 7C.
W78-09348

THE IMPACT OF SEASONAL FLOW CHARACTERISTICS AND DEMAND PATTERNS ON REQUIRED RESERVOIR STORAGE,
Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 4A.
W78-09350

A MOISTURE-ACCOUNTING WATERSHED MODEL FOR SINGLE-STORM EVENTS BASED ON TIME-AREA CONCEPT,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2A.
W78-09351

HYDROLOGIC EFFECTS OF THE TONKAWA CREEK FLOOD ABATEMENT PROGRAM,
Agricultural Research Service, Chickasha, OK. Southern Great Plains Water Research Center.
For primary bibliographic entry see Field 4A.
W78-09461

HYDROLOGIC DATA FOR LITTLE ELM CREEK, TRINITY RIVER BASIN, TEXAS, 1976,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09736

TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
E. M. Miller.
Water-Resources Investigations 78-5, January 1978. 83 p, 2 fig, 2 plates, 5 tab, 23 ref.

Descriptors: *Floods, *Frequency analysis, *Analytical techniques, *Virginia, *Streams, Gaging stations, Peak discharge, Flow rates, Regression analysis, Drainage area, Channel morphology, Topography, Geomorphology, Flood recurrence interval, *Basin characteristics.

A technique is presented for estimating the magnitude and frequency of floods in Virginia. For 299 gaged sites, the magnitudes of floods having recurrence intervals of 2 to 100 years are provided in tables. For ungaged sites, regression relations are presented that allow the estimation of flood magnitudes based on upstream drainage area, average main-channel slope, and a factor of account for regional variations in basin terrain characteristics that would bias the results. A summary of maximum known peak discharges are presented for 363 sites together with the relationship of drainage-area size to flow in cubic feet per second per square mile. Also included is a table of 10 basin characteristics for 403 gaging stations. (Woodard-USGS)
W78-09737

HYDROLOGIC DATA FOR MOUNTAIN CREEK, TRINITY RIVER BASIN, TEXAS, 1976,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09751

2F. Groundwater

STRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK OF PART OF THE COASTAL PLAIN OF TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
E. T. Baker, Jr.
Open-file report 77-712, March 1978. 32 p, 15 fig, 1 tab, 34 ref.

Descriptors: *Groundwater availability, *Water quality, *Aquifer characteristics, *Texas, *Gulf Coastal Plain, *Stratigraphy, Hydrogeology, Geologic mapping, Catahoula Sandstone, Jasper aquifer, Burkeville confining layer, Evangeline aquifer, Chicot aquifer.

The subsurface delineation of hydrogeologic units of Miocene and younger age and stratigraphic units of Paleocene to Holocene age establishes and interrelationship of these units statewide across much of the Coastal Plain of Texas. The 11 dip sections and 1 strike section, which extend from the land surface to 7,600 feet below sea level, provide continuity of correlation from the outcrop to the relatively deep subsurface. Sand containing water with less than 3,000 milligrams per liter of dissolved solids, which is shown on the sections,

serves as an index of water availability of this quality. (WoodardrUSGS)
W78-09310

PREDICTING BASE FLOW USING HYDROGEOLOGIC PARAMETERS,
Agricultural Research Service, Chickasha, OK. Southern Great Plains Watershed Research Center.
For primary bibliographic entry see Field 4D.
W78-09334

NON-STEADY SPHERICAL FLOW TO A CAVITY WELL IN AN INFINITE NON-LEAKY AQUIFER,
Iowa State Univ., Ames. Dept. of Agricultural Engineering.
R. S. Kanwar, and H. S. Chauhan.
Water Resources Bulletin, Vol. 14, No. 3, p 605-612, June 1978. 1 fig, 10 ref.

Descriptors: *Groundwater, *Groundwater movement, *Water wells, *Model studies, Mathematical models, Equations, Aquifers, Wells, Drawdown, Hydraulic conductivity, Confined water, Unsteady flow, Pumping, Hydraulics, Hydrology, Cavity wells.

The non-steady drawdown distribution near a cavity well discharging from an infinite non-leaky artesian aquifer was presented. The variation of drawdown with time and distance caused by a cavity well of constant discharge in a confined aquifer of uniform thickness and uniform permeability was obtained. The solution was expressed in a series form which converged rapidly so that only two terms of the series are needed to obtain an accuracy of more than 95%. A simplified approach was suggested to find the aquifer characteristics. (Sims-ISWS)
W78-09335

SOLUTIONS OF BOUSSINESQ'S EQUATION FOR SEEPAGE FLOW,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
A. B. Gureghian.
Water Resources Research, Vol. 14, No. 2, p 231-236, April 1978. 6 fig, 2 tab, 19 ref.

Descriptors: *Seepage, *Equations, *Groundwater, Seepage control, Ditches, Finite element analysis, Hydrology, Soils, Channels, Mathematical studies, *Boussinesq's equation, Hele-Shaw analog, Finite difference method.

Solutions of Boussinesq's equation for groundwater seepage from a ditch with vertical sides extending in depth to a horizontal impermeable floor were obtained numerically by using the finite difference and finite element methods for the case when the seepage rate from the ditch into the soil is constant with time. Both solutions agreed satisfactorily with experimental results from a Hele-Shaw analog. It was found, however, that the execution time in the computer for the finite difference method was an order shorter than that for the finite element method, and thus the finite difference method is to be preferred. The finite difference method also was used to obtain a numerical solution for the reverse situation when water seeps out of the soil into the ditch at a constant rate. (Lee-ISWS)
W78-09343

ESTIMATING RECHARGE FOR EPHEMERAL STREAMS IN ARID REGIONS: A CASE STUDY AT KAIROUAN, TUNISIA,
Ecole Nationale Superieure Des Mines de Paris, Fontainebleau (France). Center for Geological Information.
M. Besbes, J. P. Delhomme, and G. De Marsily.
Water Resources Research, Vol. 14, No. 2, p 281-290, April 1978. 9 fig, 3 tab, 14 ref.

Descriptors: *Africa, *Recharge, *Ephemeral streams, *Arid lands, Aquifers, Runoff, Floods, Hydrology, Estimating, Foreign countries, Foreign research, Infiltration, *Tunisia, *Kairouan(Tunisia), Runoff-recharge relationship.

On the assumption that the behavior of an aquifer is linear, it was shown that recharge from an ephemeral streanm can be computed by deconvolution of the fluctuations of the piezometers in the vicinity of the stream. First, the 'impulse response' of the piezometer has to be determined, either from an exceptional flood event or with the help of a digital model of the aquifer. Application of this method to the plain of Kairouan (Tunisia) proved to give estimates of rechare during a 5-year period within the same order of magnitude as direct volume estimates obtained by an automatic contouring technique of the recovery of the aquifer after infiltration (kriging). An empirical runoff-recharge relationship then was determined to extend the estimation of recharge to a 23-year period. (Lee-ISWS)
W78-09344

HYDRAULIC CONDUCTIVITY OF UNSATURATED POROUS MEDIA: GENERALIZED MACROSCOPIC APPROACH,
Colorado State Univ., Fort Collins. Engineering Research Center.
For primary bibliographic entry see Field 2G.
W78-09346

CONCENTRATION-DEPENDENT DIFFUSION APPLIED TO GROUNDWATER CONTAMINATION PROBLEMS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W78-09354

FLOW THROUGH UNCONFINED AQUIFERS CONTAINING INTERCEPTOR DRAINS,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
For primary bibliographic entry see Field 4B.
W78-09355

UNSTEADY FLOW TO A PUMPED WELL IN AN UNCONFINED FISSURED AQUIFER,
Sheffield Univ. (England). Dept. of Civil and Structural Engineering.
N. S. Boulton, and T. D. Streltsova-Adams.
Journal of Hydrology, Vol. 37, No. 3/4, p 349-363, May 1978. 7 fig, 4 ref.

Descriptors: *Aquifers, *Drawdown, *Mathematical models, *Pumping, Groundwater movement, Unsteady flow, Fissures(Geologic), Fracture permeability, Flow, Water table aquifers, Model studies, Wells, Analytical techniques, Porous media, Mathematical studies, Theoretical analysis, Equations, Fissured aquifer.

A new equation was derived for the fissure drawdown in a fractured aquifer under water table conditions. The fractured aquifer was assumed to consist of block-and-fissure units. The compressibility of both the porous blocks and the adjoining fissures was taken into account. The differential equation for the flow to a well in confined and unconfined fissured formation was derived. The abstraction well, which is pumped at a constant rate, is of full penetration. Type curves for the fissure drawdown were computed and plotted in double logarithmic coordinates, has two inflection points: the first is associated with an apparent delayed elastic deformation of fractured media, and the second corresponds to the quasi-steady flow conditions of an unconfined aquifer. Two exponential integral curves (Theis curves) approximate the initial S-shaped form segment of the time-drawdown curve. The first curve is based on the storage coefficient for the porous block. The final segment of the time-drawdown curve is approaching the exponential integral based on the specific yield for water-table conditions. A critical discussion of the theory for the flow of groundwater in fissured rocks was given. (Humphreys-ISWS)
W78-09356

NUMERICAL STUDY OF INTERACTIONS BETWEEN BOUNDARY CONDITIONS AND SOLUTIONS OF THE LINEAR DISPERSION EQUATION (ETUDE NUMERIQUE DE L'INFLUENCE DES CONDITIONS AUX LIMITES SUR LES SOLUTIONS DE L'EQUATION DE LA DISPERSION POUR UN ECOULEMENT UNIDIMENSIONNEL),
Montpellier-2 Univ. (France). Lab. d'Hydrologie Mathematique.
F. Brissaud, F. Lambert, and P. Couchat.
Journal of Hydrology, Vol. 37, No. 3/4, p 365-377, May 1978. 7 fig, 8 ref.

Descriptors: *Porous media, *Flow, *Mathematical models, *Boundary processes, *Dispersion, Earth-water interfaces, Model studies, Analytical techniques, Analysis, Mathematical studies, Numerical analysis, Equations, Peclet number.

At low Peclet's numbers, solutions of the dispersion equation for a linear flow in porous columns are affected greatly by the boundary condition at the entrance of the column. Including an entrance chamber which precedes the porous bed in mathematical models yields a more realistic simulation of the physical processes involved. Hence, the concentration distributions are also depending upon the ratio of concentration gradients on both sides of the entrance section of the bed. Mathematical simulations showed that the standard flux-type boundary condition leads to better predictions as the porous medium is more dispersive and the entrance chamber shorter. (Humphreys-ISWS)
W78-09357

NONSTEADY DRAIN FUNCTION FOR PARALLEL FLOW IN LEAKY AQUIFERS,
Department of the Environment, Ottawa (Ontario). Inland Waters Directorate.
A. Vandenberg.
Journal of Hydrology, Vol 37, No 3/4, p 379-385, May 1978. 1 fig, 5 ref.

Descriptors: *Aquifers, *Drainage, *Mathematical models, *Leakage, Unsteady flow, Steady flow, Canal seepage, Analytical techniques, Analysis, Model studies, Mathematical studies, Theoretical analysis, Equations, Drawdown, Excavation, Porous media, *Leaky aquifers.

Nonsteady state equations for the drainage of a leaky aquifer to a linear excavation were derived, and their relationship to a previously tabulated function, also occuring in the theory of leaky aquifers, was established. It was shown that derived expressions for hydraulic potential and flow contain the expressions for the steady-state, leaky case and the nonsteady, nonleaky case published previously by Edelman. (Humphreys-ISWS)
W78-09358

TRANSIENT WATER INFILTRATION WITH CONSTANT SURFACE FLUX,
Polytechnic Inst. of New York, Brooklyn. Dept. of Chemical Engineering.
S. H. Lin.
Journal of Hydrology, Vol. 37, No. 3/4, p 387-392, May 1978. 2 fig, 11 ref.

Descriptors: *Porous media, *Infiltration, *Unsaturated flow, *Mathematical models, Analytical techniques, Groundwater recharge, Flow, Numerical analysis, Model studies, Diffusion, Analysis, Moisture content, Profiles, Rehovot sand.

The water infiltration in vertical unsaturated porous media with constant water flux at the surface was investigated. The orthogonal collocation method was employed for solving the governing nonlinear partial differential equation. The numerical solutions for water infiltration in the Rehovot sand are in good agreement with the previous ones obtained by the finite-difference method. However, because of its high accuracy, computational stability, and easy application, the orthogonal collocation does provide a good alternative for solving the nonlinear water infiltration problems. (Humphreys-ISWS)
W78-09359

CALIBRATION OF A MATHEMATICAL MODEL OF THE ANTELOPE VALLEY GROUND-WATER BASIN, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
T. J. Durbin.
Available from Supt. of Documents, GPO, Washington, DC 20402; price $7.25. Water-Supply Paper 2046, 1978. 51 p, 17 fig, 13 plates, 2 tab, 33 ref.

Descriptors: *Aquifer characteristics, *Model studies, *Mathematical models, *Groundwater basins, *California, Data collections, Finite element analysis, Analytical techniques, Hydrogeology, Groundwater movement, Water wells, Pumping, Drawdown, Groundwater recharge, Water level fluctuations, Potentiometric level, Transmissivity, Storage coefficient, Maps, *Antelope Valley(Calif), Los Angeles County, Kern County.

Antelope Valley is a closed topographic basin in the western part of the Mojave Desert in southern California. A ground-water basin with a surface area of 900 square miles and a thickness of as much as 5,000 feet underlies the valley floor. The ground-water system consists of two alluvial aquifers separated by fine-grained lacustrine deposits. During the last 50 years, pumpage of ground water in excess of natural recharge has resulted in the steady decline of the ground-water level in the basin. The change in water level has been as much as 200 feet. By 1972 the cumulative overdraft was about 9 million acre-feet. To help evaluate the possible impact of various water management alternatives, a mathematical model of the ground-water basin was constructed. The model was calibrated by comparing the computed hydraulic heads of the corresponding prototype water levels for both steady-state and transient-state conditions. For the steady-state model the area-weighted median deviation of the computed hydraulic heads from the prototype water levels was 12 feet. For the transient-state model the median deviation was 25 feet. The mathematical model is based on the governing equations of ground-water flow. The solution to the equations was approximated numerically by the Galerkin-finite element method. Thirteen maps depict aquifer characteristics in Antelope Valley. (Woodard-USGS)
W78-09741

GROUND-WATER BASIC DATA FOR DICKEY AND LA MOURE COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09743

SUMMARY OF WATER RESOURCES FOR THE CAMPO, CUYAPAIPE, LA POSTA, AND MANZANITA INDIAN RESERVATIONS AND VICINITY, SAN DIEGO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09746

GEOCHEMICAL AND HYDROLOGIC DATA FOR WELLS AND SPRINGS IN THERMAL-SPRING AREA OF THE APPALACHIANS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09754

HYDROGEOLOGY OF THE OBSERVATION WELL SITE AT THE U.S. GEOLOGICAL SURVEY NATIONAL CENTER, RESTON, VIRGINIA,
Geological Survey, Reston, VA. Water Resources Div.
J. D. Larson.
Open-file report 78-144, 1978. 35 p, 9 fig, 4 tab, 8 ref. append.

Descriptors: *Observation wells, *Virginia, *Aquifer characteristics, *Hydrogeology, *Transmissivity, Water quality, Water yield, Lithologic logs, U.S. Geological Survey National Center, *Reston(Va), Triassic rocks.

The U.S. Geological Survey's National Center is on a 105-acre tract straddling rocks of two distinct types. These are pelitic schists of late Precambrian or early Paleozoic age; and sandstone, shale, siltstone, conglomerate, and diabase of Triassic age. Two observation wells and two core holes were drilled on the part of the property underlain by Triassic sedimentary rocks. The wells were drilled to monitor water levels, for equipment testing and to determine the hydraulic properties of the Triassic rocks. Geophysical logs were run and lithologic logs prepared from drill cuttings and cores. An aquifer test was conducted and indicated that the transmissivity is about 40 sq ft/day. Flowmeter surveys showed that the water comes from two thin zones, presumably bedding plane partings. The flowmeter surveys, core samples, and geophysical logs suggest that the Triassic sandstone is a fractured-rock aquifer. A water sample taken at the close of the aquifer test was low in dissolved solids, soft, and of excellent quality. (Woodard-USGS)
W78-09757

2G. Water In Soils

EXCHANGEABLE SODIUM AND SOIL WATER BEHAVIOR UNDER FIELD CONDITIONS,
Central Soil Salinity Research Inst., Karnal (India).
C. L. Acharya, and I. P. Abrol.
Soil Science, Vol. 125, No. 5, p 310-319, May 1978. 9 fig, 1 tab, 15 ref.

Descriptors: *Sodium, *Soil management, *Alkaline soils, *Irrigation water, *Soil chemical properties, Infiltration, Permeability, Soil analysis, Soil chemistry, Soil physical properties, Soil analysis, Soil water, Leaching, Land reclamation, Irrigation water, Irrigation effects, *Exchangeable sodium, *Sodic soils, *India.

The effect of exchangeable sodium on soil water behavior under field conditions was investigated in five differentially gypsum treated plots of a highly sodic soil. The soil is representative of the sodic soils of the Indo-gangetic plains in northern India. The soil texture is sandy loam in the surface 0-15 cm, and the clay fraction is dominantly illitic. Exchangeable sodium percentage (ESP) varied from 4 to 38 in 0-15 cm, and 28 to 88 in the 15-30-cm layer. Basic intake rate of the soil increased from 8.7 mm per day in soil of highest ESP to about 25 mm per day in soil of lowest ESP. Higher basic intake rate and increased retention at low suctions resulted in greater profile water storage. Soil water diffusivity values (D) calculated from the water distribution following evaporation showed that at a water content of 0.22 cu cm/cu while D (sq cm/day) decreased from 34 to 26 when ESP increased from 4 to 11, the D value sharply decreased to 8 with a further rise in ESP to 16. Improvement in transmission characteristics resulting from lowered ESP was reflected in the drying pattern of soils. The first stage of drying was delayed in low ESP treatments compared to the high ESP treatment because of regular movement of water from lower layers to the surface to meet the evaporation demand. The effect of treatments on water movement was noticeable to a depth of 90 cm studies in these experiments, although the improvement in layers below 15 cm was very small in treatments receiving lower doses of gypsum. (Henley-ISWS)
W78-09329

SOLUTIONS OF BOUSSINESQ'S EQUATION FOR SEEPAGE FLOW,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
For primary bibliographic entry see Field 2F.
W78-09343

HYDRAULIC CONDUCTIVITY OF UNSATURATED POROUS MEDIA: GENERALIZED MACROSCOPIC APPROACH,
Colorado State Univ., Fort Collins. Engineering Research Center.
Y. Mualem.
Water Resources Research, Vol. 14, No. 2, p 325-334, April 1978. 2 fig, 5 tab, 41 ref. NSF ENG-7611542.

Descriptors: *Hydraulic conductivity, *Porous media, *Unsaturated flow, *Mathematical models, Equations, Theoretical analysis, Soil texture, Statistical models, Porosity, Specific yield, Curves, Soils, Permeability, Saturation, Wetting, Wilting point, Effective saturation, Unsaturated soils.

The macroscopic approach which yields the power function relationship between the relative permeability and the effective saturation, K sub r = S sub e to the n power, was generalized to allow n to vary with the soil type. Theoretical analysis shows that n may receive values lower than 3.0 for granular porous media and higher than 3.0 for soils of the fine texture. These findings were verified by using experimental data of 50 soils. The lower limit of n was found to be 2.5, while high values (up to n = 24.5) were found for the fine-textured soils. Statistical analysis of the measured data of the 50 soil samples showed a significant correlation between n and w, which indicates the amount of work per unit volume of soil required to drain a saturated soil to the wilting point. By using the soil characteristics psi-theta, an empirical formula was derived which relates n to w by n = 0.015w + 3.0. This proposed model was compared with the two previous versions of Averjanov and Irmay on the basis of the experimental data of the 50 soils. A very good agreement was found between the measured K sub r - theta curves and the theoretical ones, derived by the new model, for granular soils as well as for soils of fine texture where the other models very often fail. The accuracy of the new model is competitive with the best of the statistical models analyzed by Mualem. By this study, the power function model gains a high degree of accuracy, which, compounded by its simplicity, produces an efficient tool for prediction of the hydraulic conductivity of unsaturated soils. (Visocky-ISWS)
W78-09346

A MODEL FOR THE WATER REGIME OF CONIFEROUS FOREST AND GRASSLAND,
Swiss Forestry Research Inst., Birmensdorf (Switzerland).
For primary bibliographic entry see Field 2D.
W78-09353

NUMERICAL STUDY OF INTERACTIONS BETWEEN BOUNDARY CONDITIONS AND

SOLUTIONS OF THE LINEAR DISPERSION EQUATION (ETUDE NUMERIQUE DE L'INFLUENCE DES CONDITIONS AUX LIMITES SUR LES SOLUTIONS DE L'EQUATION DE LA DISPERSION POUR UN ECOULEMENT UNIDIMENSIONNEL),
Montpellier-2 Univ. (France). Lab. d'Hydrologie Mathematique.
For primary bibliographic entry see Field 2F.
W78-09357

TRANSIENT WATER INFILTRATION WITH CONSTANT SURFACE FLUX,
Polytechnic Inst. of New York, Brooklyn. Dept. of Chemical Engineering.
For primary bibliographic entry see Field 2F.
W78-09359

APPLICATION OF DIGESTED SLUDGE FOR IMPROVING ERODED SOIL CAUSED BY SO2,
Chinese Univ. of Hong Kong. Dept. of Biology.
For primary bibliographic entry see Field 5E.
W78-09420

ANION MOBILITY IN SOILS: RELEVANCE TO NUTRIENT TRANSPORT FRO M TERRESTRIAL TO AQUATIC ECOSYSTEMS,
Washington Univ., Seattle. Coll. of Forest Resources.
For primary bibliographic entry see Field 5B.
W78-09442

INFLUENCE OF TRICKLE AND SURFACE IRRIGATION ON RETURN FLOW QUALITY,
New Mexico State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 5G.
W78-09443

SOIL WATER DEPLETION AFTER FOUR YEARS OF FOREST REGROWTH IN SOUTHWESTERN WISCONSIN,
North Central Forest Experiment Station, St. Paul, MN.
For primary bibliographic entry see Field 4C.
W78-09524

CHARACTERISTICS OF ARIZONA PONDEROSA PINE STANDS ON SANDSTONE SOILS,
Arizona Univ., Tucson.
For primary bibliographic entry see Field 3B.
W78-09528

HEAT AND WATER TRANSPORT PROPERTIES IN CONIFER DUFF AND HUMUS,
Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO.
M. A. Fosberg.
Department of Agriculture, Forest Service, Research Paper RM-195, 10 p, November, 1977. 4 fig, 27 ref, 1 tab, append.

Descriptors: *Fuels, *Soil water, *Moisture content, *Humus, *Infiltration, *Permeability, Bulk density, Forest soils, Lodgepole pine trees, Ponderosa pine trees, Pine trees, Douglas fir trees, Conifers, Coniferous forests, Water vapor, Heat transfer, Diffusion, Duff.

Permeability and bulk densities of duff and humus in stands of ponderosa pine, lodgepole pine, and Douglas-fir were measured to provide a data base for fuel moisture and soil infiltration models. Diffusion of heat and water vapor through a ponderosa pine duff layer was measured to calibrate a diffusion model. These results provide necessary data and relationships required by complex forest soil water balance and energy models. (Witt-IPC)
W78-09529

A SELF-PROPELLED HIGH-CLEARANCE SOIL CORING MACHINE,
Texas A and M Univ. Lubbock. Agricultural Research and Extension Center.
For primary bibliographic entry see Field 7B.
W78-09654

MASSIVE ACCUMULATION OF CALCIUM CARBONATE AND ITS RELATION TO NITROGEN FIXATION OF SAINFOIN,
Wyoming Univ., Laramie. Div. of Plant Science.
W. D. Ross, and R. H. Delaney.
Agronomy Journal, Vol. 69, No. 2, p 242-246, March-April 1977. 2 fig, 3 tab, 25 ref.

Descriptors: Lagoons, *Calcium carbonate, *Nitrogen fixation, Soils, Soil investigations, *Sainfoin.

Sainfoin has many desirable qualtities as a legume forage, but it is not widely grown because of its lack of persistence and poor N-fixation on many sites. The effect of competition by non-N-fixing soil microorganisms on N-fixation was studied at 0, 50, 80, 95, and 100% levels of autoclaved soil sterilization. Plants were grown aseptically for 30 days, dipped in Rhizobium inoculum, and transplanted to the sterlized soil. After 47 and 87 days in the growth chamber at 24/18C, the plants were harvested. Nitrogen fixation was determined by the acetylene reduction capacity of the complete root system. Unexpectedly, root distortion accompanied by massive accumulation of CaCO3 was stimulated in sainfoin roots that were grown in autoclaved soil to reduce the soil microogranisms. The accumulation of Ca and its affect on N-fixation in sainfoin are described. (Skogerboe-Colorado State)
W78-09656

SOIL CONSERVATION ON AGRICULTURAL LAND: THE CHALLENGE AHEAD,
Soil Conservation Service, Washington, DC.
For primary bibliographic entry see Field 3F.
W78-09659

THE SOLUBILITIES OF CARBONATES AND PHOSPHATES IN CALCAREOUS SOIL SUSPENSIONS,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 2K.
W78-09711

HISTORY AND CHALLENGES IN SOIL AND WATER CONSERVATION AND MANAGEMENT,
Association of North Central State Agricultural Experiment Station, Ames, IA.
G. M. Browning.
Soil Science Society of America Journal, Vol. 41, No. 2, p 254-259, March-April, 1977.

Descriptors: *History, *Soil conservation, *Water conservation, *Soil management(Applied), Natural resources, Agricultural watersheds, Soil erosion, Soil surveys, Irrigation practices, Weather, Crop production, Agroclimatology, Land use, Planning, Environmental engineering, Foods, Strip mines, Research and development, Land, Water, Recreation, Evapotranspiration, Structural engineering, Irrigation efficiency, Energy, Reclamation.

Because soil management and water conservation is an important consideration in the irrigated arid lands of the Southwest U.S., this bicentennial address to th Soil Science Society of America, reviewing the history and challenges in soil and water conservation and management, show a major improvement in how natural resources are used. These challenges and opportunities remain, however, to refine and extend the universal soil loss equation, complete soil surveys, improve agricultural water use, develop relationships between weather and crop yields, improve information for land-use planning, improve the environment and meet future food requirements, improve tillage systems, and improve strip-mining operations without permanent damage to the environment and to soil productivity. Major areas of discussion are: Agricultural Research System, Soil and water conservation research, challenges ahead, land water, recreation, weather, evapotranspiration, structural measures, irrigation, land use, environment, energy, tillage, strip mine reclamation, and planning. (Popkin-Arizona)
W78-09714

FITTING SOLUTE BREAKTHROUGH EQUATIONS TO DATA USING TWO ADJUSTABLE PARAMETERS,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
A. M. Elprince, and P. R. Day.
Soil Science Society of America Journal, Vol. 41, No. 1, p 39-41, January-February, 1977. 1 tab, 2 fig, 20 ref.

Descriptors: *Soil water movements, *Ion transport, *Anion adsorption, *Dispersion, *Diffusion, Solutes, Equations, Calcium compounds, Mathematical models, Chlorides, Calcium chloride, Leaching, Anions, Regression analysis, Stagnant water, Convection, Columns, Soil chemical properties, Laboratory tests, Mathematical studies, Anion adsorption.

In this study, solute breakthrough curves are determined in many soil-water studies under irrigated, leached, landfills, sewage lagoons, or other possibly contaminated areas. The equations for such curves are reviewed, and an experiment with Hanford sandy loam is discussed. The experiment involved saturating the soil with calcium nitrate prior to leaching with calcium chloride, and fitting the chloride breakthrough curve with two adjustable parameters. The parameters account for two problems encountered in breakthrough phenomena: (1) negative adsorption of anions, which reduces the volume of liquid available for solute transport; (2) appreciable volumes of stagnant soil solution, which do not contribute to the convective flux. Calculations demonstrate that a least square procedure, applied simultaneously to the two parameters during curve fitting, resolves the discrepancy between the theoretical and experimental breakthrough. Soil volume data on the laboratory experiment, and chloride breakthrough curves using one and two adjustable parameters are given. (Popkin-Arizona)
W78-09715

DETERMINATION OF SOIL-MOISTURE REGIMES OF THE MAGHREB ACCORDING TO NEWHALL, (DETERMINATION DU REGIME HYDRIQUE DES SOLS DU MAGHREB D'APRES NEWHALL),
Ghent Rijksuniversiteit (Belgium) Geologisch Inst.
T. Travernier, and A. Van Wambeke.
Pedologie, Vol. 26, No. 2, p 168-178, 1976. 3 tab, 4 fig.

Descriptors: *Soil moisture, *Soil classification, *Water balance, *Energy budget, *Mathematical models, Soil chemical properties, Soil physical properties, Soil temperature, Soil types, Soil profile, Air temperature, Rainfall, Evapotranspiration, Computer models, Arid lands, Desertification, North Africa, Morocco, Algeria, Tunisia.

Soil-moisture regimes are important in classifying soils, and in changing soil characteristics over time, such as during desertification. A brief review of the mathematical model by Newhall is presented, simulating the water and heat budget of a soil profile, and accounting for monthly temperature, rainfall, and evapotranspiration. Examples are given which determine climatic and soil-moisture regime using the Newhall model applied

to the stations of the Maghreb, which includes Morocco, Algeria, and Tunisia in North Africa. Results of the FORTRAN model are given in tables, which indicate thermic temperatures for Xeric and Ustic moisture regimes, and mesic to hyperthermic temperatures for Aridic moisture regimes. (Popkin-Arizona)
W78-09718

CONTRIBUTION TO THE MICROMORPHOLOGY OF SOME SALINE SOILS OF THE NORTH NILE DELTA IN EGYPT,
National Research Centre, Cairo (Egypt). Soils Lab.
F. S. Hanna, and G. J. Stoops.
Pedologie, Vol. 26, No. 1, p 55-73, 1976. 6 fig, 1 tab, 9 ref.

Descriptors: *Saline soils, *Salts, *Irrigation water, *Soil formation, *Soil classification, Arid lands, Soil profiles, Calcium carbonate, Organic matter, Electrical conductance, Cations, Anions, Halides, Gypsum, Coastal plains, Stratification, Cultivated lands, Drainage, Clay minerals, Soil chemistry, Soil texture, Soil structure, Land reclamation, Nile Delta, Egypt.

Saline soils of the northern Nile Delta occupy more than 400,000 acres of land, uncultivated because of high salt content and shortage of good irrigation water. This study describes the micromorphology of seven representative saline soils. Soil profiles (pedon descriptions), profile photographs, and analytical data (grain size distribution, pH, CaCO3, OM, EC, total soluble salts, cations and anions) for each horizon are provided. Four soils are Salorthids, or fluviomarine flats. Diffuse iron exihydrate gluebules in the G-horizon, halite cutans on most fissures and ped surfaces, lenticular gypsum crystals, and thin surface crusts are micromorphological characteristics of the Salorthids. Two soils are Halaquepts, and represent uncultivated sandy soils of the coastal plains. These are stratified, and generally free of halite cutans and gypsum crystals except in clayey or loamy bands. A final cultivated soil of the coastal plain is described for comparison. It is unstratified in the upper or cultivated layers, and exhibits a higher biological activity. Poor drainage is exhibited by clayey soils, and is caused in part by diffuse and irregular Fe-Mn-oxihydrate nodules, concretions or neoferrans. Calcite occurs dispersed or as diffuse layers. Lenticular gypsum crystals are found throughout the profiles. Halite cutans cover walls of most cavities, and are most striking. The mineralogy, texture, structure, and micromorphology of the saline soils explain their resistance to cultivation and reclamation. (Popkin-Arizona)
W78-09719

CLAY IN RELATION TO PEDALITY AND STABILITY OF MICROSTRUCTURE IN NILE ALLUVIAL SOILS,
Cairo Univ., Giza (Egypt). Dept. of Soils.
A. Fathi, I. A. Zein el Abedine, F. Labib, and A. A. Wahdan.
Egyptian Journal of Soil Science, Vol. 16, No. 1, p 93-112, 1976. 7 tab, 20 ref.

Descriptors: *Clays, *Soil stability, *Allunium, *Soil texture, *Soil structure, Azonal, Soil management, Soil moisture, Soil water movement, Fine-textured soils, Soil profiles, Drainage, Air circulation, Particle size, Geomorphology, Soil chemistry, Arid lands, Pedality, Microstructure, Egypt.

Nile alluvial soils are young azonal soils, formed in recent times by sedimentation of suspended matter. The pedality of the non-saline and non-alkali alluvial soils of Egypt is affected by clay and management. The Ap horizons show apedal structures, which are subject to management. The Chorizona are dependent on clay content. The increase of clay changes soil structure for apedal to pedal, and reduces water movement and drainage. Air exchange and gas transfer is also inhibited by increased clay content in the soil profile. Tables show the impact of clay content on morphology, particle size (soil texture), soil chemistry, micromorphology, and soil structure on Nile alluvial soils. (Popkin-Arizona)
W78-09722

A SIMULATION MODEL APPROACH FOR RELATING EFFECTIVE CLIMATE TO WINTER WHEAT YIELDS ON THE GREAT PLAINS,
Barnard Coll., New York.
D. W. Bridge.
Agricultural Meteorology, Vol. 17, p 185-194, 1976. 5 tab, 22 ref.

Descriptors: *Hydrologic budget, *Model studies, *Wheat, *Crop production, *Great Plains, Semiarid climates, Plant growth, Root systems, Soil-water-plant relationships, Oil moisture, Seeds, Consumptive use, Air temperature, Precipitation(Atmospheric), Runoff coefficients, Evapotranspiration, Moisture availability, Seasonal, Period of growth, Regression analysis, Simulation Analysis.

A modified water budget model is discussed that simulates an increase in root depth as winter wheat progresses from seed to maturity and the soil moisture available to the plant as a result of root growth. The model uses the daily Thornthwaite water budget (which requires daily mean temperature and precipitation), soil moisture capacity, initial soil moisture, station latitude, and long-term monthly temperatures for all twelve months. The model also uses direct runoff coefficients, a linearly decreasing soil-moisture availability curve, and a 300-mm soil-moisture storage capacity. It predicts potential evapotranspirtion (PE), actual evapotranspiration, surplus water, soil moisture deficit, and soil moisture for each growing-season day for Kharkov winter wheat in four stations in Oklahoma, Nebraska, and Montana on the Great Plains. Selected variables were summed over time from planting to maturity by stepwise linear regression, which formed equations 'explaining' reasonable percentages of yield variations at the four sites. The simulation model uses the water budget and allows for changing root depth. The climatic parameters generated by the expanding root zone simulation model by regression, were regressed against wheat yield for comparison. Regression and correlation coefficients are tabulated. Correlations of wheat yield with precipitation and PE were low but correlation of wheat yields with all generated variables improved considerably. The study reinforces findings that there is a superior association between wheat yields and parameters derived with crop water budget models as opposed to simple energy and moisture variables. (Popkin-Arizona)
W78-09723

OBSERVATIONS OF SOIL WATER AND SALT MOVEMENT UNDER DRIP AND FLOOD IRRIGATION IN AN APPLE ORCHARD,
Commonwealth Scientific and Industrial Research Organization, Merbein (Australia). Div. of Horticultural Research.
For primary bibliographic entry see Field 3C.
W78-09762

PROCEDURES FOR EVALUATION OF DRAINAGE BENEFITS FOR AGRICULTURAL CROPS,
Soil Conservation Service, Lincoln, NE. Midwest Technical Service Center.
D. W. Manley.
Paper No. 77-2590 presented at the 1977 Winter Meeting of the American Society of Agricultural Engineers, December 13-16, 1977, Chicago, Illinois, 6 p, 6 tab.

Descriptors: *Economics, *Drainage, Agriculture, *Crop production, Drainage practices, Drainage systems, *Evaluation, Benefits.

The basic concepts and procedures used by the Soil Conservation Service for making an economic analysis of drainage for agricultural crops are described. (Skogerboc-Colorado State)
W78-09765

SOIL AND WATER CONSERVATION PRACTICES FOR POLLUTION CONTROL,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5G.
W78-09768

CAPILLARY POTENTIAL DISTRIBUTIONS IN ROOT ZONES USING SUBSURFACE IRRIGATION,
Department of Agriculture, Watkinsville, GA.
A. W. Thomas, H. R. Duke, and E. G. Kruse.
Transactions of the American Socity of Agricultural Engineers, Special Edition, Vol. 20SW, p 62-67, February 20, 1977. 11 fig, 8 ref.

Descriptors: Infiltration, *Root zones, *Subsurface irrigation, Corn(Field), Irrigation systems, Soils, Irrigation design, *Capillary water.

An experimental study was conducted of infiltration from buried sources which represented field irrigation laterals. Capillary potentials in the root zone of barley and corn were measured during the growing season and compared with measured and calculated steady-state values. Design evaluation of subsurface irrigation system was introduced and example calculations were presented. (Skogerboc-Colorado State)
W78-09770

SOIL-SALT INTERACTIONS IN RELATION TO SALT CONTROL,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 5G.
W78-09771

MANAGEMENT OF BED-FURROW IRRIGATED SOIL WITH LIMITED AND NO-TILLAGE SYSTEMS,
Southwestern Great Plains Research Center, Bushland, TX.
For primary bibliographic entry see Field 3F.
W78-09777

GYPSUM BLOCKS, TENSIOMETERS RELIABLE SOIL MOISTURE MONITORS.
For primary bibliographic entry see Field 3F.
W78-09781

TEMPERATURE GRADIENT EFFECTS ON IN SITU HYGROMETER MEASUREMENTS OF WATER POTENTIAL,
Utah State Univ., Logan.
H. H. Wiebe, R. W. Brown, and J. Baker.
Agronomy Journal, Vol. 69, No. 6, p 933-939, November-December, 1977. 6 fig, 1 tab, 17 ref.

Descriptors: Temperature, *Hygrometry, Soil water, Soil moisture, Soil properties, Soils, Measurement.

The effects of temperature gradients on water potential measurements with various commercial and laboratory soil hygrometers were tested in a soil column at -18 bars or in a sponge column wetted with a -18 bar sodium chloride solution. Temperature gradients were induced in the medium by warming or cooling either the base or the top of the column for several hours. Hygrometers in which the measuring (wet) junction was located

in the middle of the cylindrical sample surface gave small temperature gradient errors, less than 3 bars when the temperature gradient in th surrounding medium was 1 degree cm(-1). Locating the measuring thermocouple near the base of the cylindrical sample surface gave errors ranging from 10 to 18 bars per gradient of 1 degree cm(-1). Hygrometers with an 'end window' sample surface gave errors ranging from 23 to 62 bars. Water potential readings were consistently too low (dry) when the sample surface was cooler than the measuring junction, and too high (near zero) when the sample was warmer. Accurate water potentials were obtained with all models when medium temperature was uniform. (Skogerboe-Colorado State)
W78-09782

THE MINIMUM SIZE OF PERMEABLE FILL USED WITH MOLE DRAINAGE,
Ministry of Agriculture, Fisheries and Food, Cambridge (England). Field Drainage Experiment Unit.
C. W. Dennis, and S. G. Croote.
Agricultural Water Management, Vol. 1, No. 2, p 143-153, September, 1977. 7 fig, 1 tab, 6 ref.

Descriptors: *Mole drainage, Drainage engineering, *Drainage practices, Drainage systems, *Drains, Hydraulic conductivity.

Laboratory work involving the full scale simulation of flow from a mole drainage channel into a trench filled with permeable material and thence to the pipe drain at the bottom of the trench is described. Four sizes of permeable fill, two trench widths, two pipe types and a wide range of flow rates were used in the investigations. Provided that there was reasonable vertical separation between the mole channel and pipe the flow could be divided into three distinct phases: entry from the mole channel, near vertical flow within the permeable fill and entry into the pipe. The most limiting of these was the ability of the fill to accept water from the mole channel. Variation of hydraulic head with flow rate and permeable fill size at critical points of the system is presented in graphical form. It is suggested that permeable fill with a mean diameter of 5 mm is the minimum size acceptable under United Kingdom conditions and that this result will not be affected by the presence of a small quantity of fine material. The hydralic conductivity associated with such material, in the absence of fines, is approximately 2500 m/day. Application of the data to other design conditions is also possible. (Skogerboe-Colorado State)
W78-09786

A MODEL FOR THE TRANSPORT OF PESTICIDES IN SOIL WITH DIFFUSION-CONTROLLED RATES OF ADSORPTION AND DESORPTION,
Laboratorium voor Insekticide-nonderzoek TNO, Wageningen (Netherlands).
For primary bibliographic entry see Field 5B.
W78-09790

FIELD MEASUREMENTS OF AMMONIA VOLATILIZATION FROM SURFACE APPLICATIONS OF AMMONIUM SALTS TO A CALCAREOUS SOIL,
Agricultural Research Service, Temple, TX. Blackland Conservation Research Center.
For primary bibliographic entry see Field 5B.
W78-09794

2H. Lakes

PRIMER ON LAKES IN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resouces Div.
N. P. Dion.
Washington Department of Ecology, Olympia Water-Supply Bulletin 49, 1978. 55 p, 21 fig, 96 ref.

Descriptors: *Limnology, *Washington, *Lakes, *Lake morphology, *Lake morphometry, Eutrophication, Ecosystems, Chemical properties, Biological properties, *Limnological terms.

This report was prepared to provide a nontechnical, 'layreader' introduction to the many physical, chemical, and biological characteristics of lakes. The report includes a glossary of lake and geologic terms related to lakes of Washington State--and to lakes generally-and discusses the many characteristics involved in evaluation of lake-water quality. The report is intended not only as an entity in itself but as a contribution to a better understanding by the general reader of more technical and more detailed reports on lakes in Washington. (Woodard-USGS)
W78-09307

LIMNOLOGY OF LAGUNA TORTUGUERO, PUERTO RICO,
Geological Survey, Fort Buchanan, PR. Water Resouces Div.
F. Quinones-Marquez, and L. A. Fuste.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 322, Price codes: A05 in paper copy, A01 in microfiche. Water-Resources Investigations 77-122, March 1978. 84 p, 34 fig, 15 tab, 42 ref.

Descriptors: *Limnology, *Lagoons, *Puerto Rico, Hydrology, Biological properties, Chemical properties, Physical properties, Eutrophication, Water chemistry, Data collections, Sampling, Saline water intrusion, *Laguna Tortuguero(PR).

The principal chemical, physical and biological characteristics, and the hydrology of Laguna Tortuguero, Puerto Rico, were studied from 1974-75. The lagoon, with an area of 2.24 square kilometers and a volume of about 2.68 million cubic meters, contains about 5 percent of seawater. Drainage through a canal on the north side averages 0.64 cubic meters per second per day, flushing the lagoon about 7.5 times per year. Chloride and sodium are the principal ions in the water, ranging from 300 to 700 mg/liter and 150 to 400 mg/liter, respectively. Among the nutrients, nitrogen averages about 1.7 mg/liter, exceeding phosphorus in a weight ratio of 170:1. About 10 percent of the nitrogen and 40 percent of the phosphorus entering the lagoon is retained. The bottom sediments, with a volume of about 4.5 million cubic meters, average 0.8 and 0.014 percent nitrogen and phosphorus, respectively. (Woodard-USGS)
W78-09314

EVAPORATION AND RADIATION MEASUREMENTS AT SALTON SEA, CALIFORNIA,
Geological Survey, Bay St. Louis, MS. Water Resources Div.
For primary bibliographic entry see Field 2D.
W78-09322

CHARACTERISTICS OF THE HYDROLOGIC REGIME OF LARGE SIBERIAN RESERVOIRS,
For primary bibliographic entry see Field 4A.
W78-09336

SEDIMENTATION RATES AND A REVISED SEDIMENT BUDGET FOR LAKE ERIE,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2J.
W78-09339

ATMOSPHERIC LOADING OF PHOSPHORUS AND OTHER CHEMICALS TO LAKE MICHIGAN,
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 5B.
W78-09340

ON THERMAL STRATIFICATION IN RESERVOIRS DURING THE WINTER SEASON,
National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
M. Rahman.
Water Resources Research, Vol. 14, No. 2, p 377-380, April 1978. 2 figm, 5 ref.

Descriptors: *Thermal stratification, *Reservoirs, *Seasonal, *Diffusivity, *Boundary processes, Temperature, Distribution, Ice, Solar radiation, Numerical analysis, Hydraulics, Heat transfer, *Temperature profile, Heat flux, Initial temperature condition.

A one-dimensional mathematical model describing the thermal structure in stratified reservoirs during the winter season was considered. With the help of this model, an attempt was made to clarify some of the physical factors which strongly influence the temperature profiles in reservoirs. It has been observed that there are many factors which influence the shape of the vertical temperature distribution, namely, the profile at the time of ice formation, the heat exchange by diffusion in the water mass, the heat exchange due to inflow and outflow of water in reservoirs, etc. This model accounts for a qualitative assessment of the possible effects of diffusivity and the initial shape of the temperature profiles on the variation of the vertical temperature distribution. (Sinhg-ISWS)
W78-09347

HYDROLOGIC RESPONSE MODEL OF THE NORTH AMERICAN GREAT LAKES,
National Oceanic and Atmospheric Administration, Ann Arbor. Great Lakes Environmental Research Lab.
F. H. Quinn.
Journal of Hydrology, Vol. 37, No. 3/4, p 295-307, May 1978. 5 fig, 4 tab, 8 ref.

Descriptors: *Water balance, *Model studies, *Great Lakes, *Lake Michigan, *Lake Huron, *Lake St. Clair, *Lake Erie, Hydrologic cycle, Mathematical models, Analytical techniques, Precipitation(Atmospheric), Runoff, Lakes, Tributaries, Evaporation, Discharge(Water), Open channel flow, Water levels, Water resources, Water supply.

A hydrologic response model of the unregulated portion of the North American Great Lakes was presented for use in water resource and research studies. The hydrologic response model is a water quantity model encompassing Lakes Michigan, Huron, St. Clair, and Erie, and their connecting channels. The input parameters include overwater precipitation, tributary runoff, evaporation and diversion rates for each lake in the system, and ice retardation rates and discharge equations for the connecting channels. The model outputs are end-of-month and monthly mean water levels for each lake in the system and the monthly flow rates in the connecting channels. The equation set for the model is composed of the continuity equations for each lake in the system. Runge-Kutta and Newton-Raphson algorithms were investigated for use in the model solution as well as a second-order finite-difference technique designed by the author. The Newton-Raphson algorithm required approximately 40% less computer time than the other algorithms and was selected for inclusion in the solution. The model was calibrated by parameter optimization using an optimum gradient algorithm. The accuracy of the monthly simulated flows in the connecting channels showed that for approximately 95% of the time the errors in the monthly flows will be less than 4%. The net basin supply version of the model is desirable for use in developing countries where lake levels and river rating curves may constitute the only available historical data base. (Humphreys-ISWS)
W78-09352

MARYSVILLE LAKE HYDROTHERMAL STUDY; REPORT 2, 2250-MW PROJECT; HYDRAULIC AND MATHEMATICAL MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 8B.
W78-09466

LAKE ERIE INTERNATIONAL JETPORT MODEL FEASIBILITY INVESTIGATION; REPORT 10, NONTECHNICAL SUMMARY OF PROJECT,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 6G.
W78-09467

DILLON RESERVOIR - BLUE RIVER STUDY - COLORADO, JUNE, JULY, AUGUST - 1973.
Environmental Protection Agency, Denver, CO. Region VIII.
For primary bibliographic entry see Field 5C.
W78-09533

CALCIUM AND CATION SORPTION BY CLADOPHORA FROM THE GREAT LAKES,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.
For primary bibliographic entry see Field 5C.
W78-09535

MACROPHYTES OF THE DAM RESERVOIR AT GOCZALKOWICE,
Polish Academy of Sciences, Pszczyna. Hydrobiological Station; Polish Academy of Sciences, Pszczyna. Hydrobiological Station.
For primary bibliographic entry see Field 5C.
W78-09536

QUANTITATIVE AND QUALITATIVE COMPOSITION OF BOTTOM FAUNA IN POLLUTED PARTS OF LAKE VANERN AND SOME ASPECTS ON WATER QUALITY INDICES,
Statens Naturvardsverk, Stockholm (Sweden). Undersoknings Lab.
For primary bibliographic entry see Field 5C.
W78-09537

PHOSPHATE AND SILICATE KINETICS FOR THE LAKE MICHIGAN DIATOM DIATOMA ELONGATUM,
Michigan Univ., Ann Arbor. Div. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W78-09538

PHYSICO-CHEMICAL SURVEILLANCE DATA OBTAINED FOR LAKE ONTARIO, 1974 AND THEIR RELATIONSHIP TO CHLOROPHYLL A,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5C.
W78-09539

SHORELINE EROSION IN SOUTHEASTERN WISCONSIN,
Wisconsin Geological and Natural History Survey, Madison.
For primary bibliographic entry see Field 2J.
W78-09547

CARRYING CAPACITY CONTROLS FOR RECREATION WATER USES,
Wisconsin Univ.-Madison.
For primary bibliographic entry see Field 6D.
W78-09551

REPORT OF THE DANE COUNTY ADVISORY COUNCIL FOR LAKE QUALITY IMPROVEMENT, A FRAMEWORK FOR LAKE MANAGEMENT.
Wisconsin Lake Quality Improvement Advisory Council, Madison.
For primary bibliographic entry see Field 5C.
W78-09552

INSECTICIDES, POLYCHLORINATED BIPHENYLS AND METALS IN AFRICAN LAKE ECOSYSTEMS. II. LAKE MCILWAINE, RHODESIA,
South Dakota State Univ., Brookings. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W78-09574

INSECTIDES, POLYCHLORINATED BIPHENYLS AND METALS IN AFRICAN LAKE ECOSYSTEMS. III. LAKE NAKURU, KENYA,
South Dakota State Univ., Brookings. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W78-09575

AN IN SITU DETERMINATION OF THE DISAPPEARANCE OF COLIFORMS IN LAKE MICHIGAN,
Marquette Univ., Milwaukee, WI.
For primary bibliographic entry see Field 5B.
W78-09599

U.S. RESERVOIR INVENTORY,
National Reservoir Research Program, Fayetteville, AR.
For primary bibliographic entry see Field 4A.
W78-09797

2I. Water In Plants

THE PHASED DIVISION OF THE FRESHWATER DINOFLAGELLATE CERATIUM HIRUNDINELLA: ITS USE AS A METHOD OF ASSESSING GROWTH IN NATURAL POPULATIONS,
Freshwater Biological Association, Windemere (England).
For primary bibliographic entry see Field 5C.
W78-09530

PHOTOSYNTHESIS OF SUGARBEETS UNDER N AND P STRESS: FIELD MEASUREMENTS AND CARBON BALANCE,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 3F.
W78-09653

ROLE OF CHANGES IN SOLUTE CONCENTRATION IN MAINTAINING FAVORABLE WATER BALANCE IN FIELD-GROWN COTTON,
California Univ., Davis. Dept. of Agronomy and Range Science.
For primary bibliographic entry see Field 3F.
W78-09658

CONTRIBUTION OF DEW IN THE HYDROLOGIC BALANCE OF A SEMI-ARID GRASSLAND,
Commonwealth Scientific and Industrial Research Organization, Deniliquin (Australia). Riverina Lab.
For primary bibliographic entry see Field 2B.
W78-09712

WATER LOSS FROM CUT HERBAGE IN THE WINDROW AND FROM ISOLATED LEAVES AND STEMS,
Reading Univ. (England). Dept. of Agricultural Botany.
For primary bibliographic entry see Field 2D.
W78-09720

A MONTE-CARLO MODEL FOR THE RADIATION FIELD IN PLANT CANOPIES,
Technion - Israel Inst. of Tech., Haifa. Lowdermilk Faculty of Agricultural Engineering.
I. Szwarcbaum, and G. Shaviv.
Agricultural Meteorology, Vol. 17, No. 5, p. 333-352, 1976. 11 fig, 1 tab, 5 ref.

Descriptors: *Monte Carlo method, *Statistical models, *Radiation, *Canopy, *Light, Agroclimatology, Plant growth, Photosynthesis, Crop production, Crop response, Evapotranspiration, Leaves, Reflectance, Distribution, Absorption, Analytical techniques, Numerical analysis, Albedo, Leaf reflection, Leaf distribution, Leaf orientation, Canopy geometry, Ground reflection, Light adsorption, Light scattering, Flow chart.

Radiation field in plant canopies has an important role in plant growth, photosynthesis, plant development, and evapotranspiration. A Monte-Carlo model is developed for evaluating the radiation field inside plant canopies. The model is based on tracing a parcel of light through the canopy leaves. It includes effects of leaf reflection, leaf distribution and orientation, canopy geometry, ground reflection, and other factors. The model can be expanded to include additional special features, such as light absorption and scattering, and important features of individual leaves. The Monte-Carlo model reproduces known analytical results under suitable assumptions. Numerical examples of the radiation field inside a hypothetical canopy and some albedo properties, are given. A flow-chart of the Monte-Carlo procedure is shown. (Popkin-Arizona)
W78-09721

A SIMULATION MODEL APPROACH FOR RELATING EFFECTIVE CLIMATE TO WINTER WHEAT YIELDS ON THE GREAT PLAINS,
Barnard Coll., New York.
For primary bibliographic entry see Field 2G.
W78-09723

IRRIGATION APPLICATION DEPTHS FOR OPTIMUM CROP PRODUCTION,
South Dakota State Univ., Brookings, Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W78-09779

ESTIMATING LEAF WATER POTENTIAL IN SAFFLOWER,
Pahlavi Univ., Shiraz (Iran). Dept. of Irrigation.
For primary bibliographic entry see Field 3F.
W78-09783

2J. Erosion and Sedimentation

SEDIMENT TRANSPORT IN THE TANANA RIVER IN THE VICINITY OF FAIRBANKS, ALASKA, 1977,
Geological Survey, Anchorage, AK. Water Resources Div.
W. W. Emmett, R. L. Burrows, and B. Parks.
Open-file report 78-290 (basic data), 1978. 28 p, 9 tab, 7 fig, 4 ref.

Descriptors: *Sediment transport, *Bed load, *Particle size, *Streamflow, *Alaska, Flow rates, Measurement, Hydrologic data, *Tanana River(Alas), *Fairbanks area(Alas).

Measurements during the period of principal runoff in 1977, of suspended- and bedload-sediment transport for the Tanana River in the vicinity of Fairbanks, Alaska, show that the median particle size of suspended sediment is generaly silt (<0.062 mm), but at some low-water discharges, the median particle size is very fine sand. The median particle size of bedload is generally gravel (>2.0 mm, and often in the range of 10 to 20 mm), but at some low transport rates, the median particle size is medium sand. At all water discharges and sediment-transport rates, the particles constituting the suspended load are significantly smaller than the particles constituting the bedload. Tables present data and computations. Most tables are followed by graphical presentation of the data. The majority of the text is devoted to explanation of tables and graphs. (Woodard-USGS)
W78-09318

EROSION PROCESSES ON STEEP GRANITIC ROAD FILLS IN CENTRAL IDAHO,
Forest Service (USDA) Boise, ID. Intermountain Forest and Range Experimental Station.
W. F. Megahan.
Soil Science Society of America Journal, Vol. 42, No. 2, p 350-357, March 1978. 8 fig, 1 tab, 10 ref.

Descriptors: *Erosion control, *Idaho, *Roadbanks, *Granites, Particle size, Sedimentation, Hydrology, Roads, Erosion, On-site investigations, *Erosion processes, Erosion plots, Road fills, Steep granitic roads, Dry creep.

A set of thirty 20.2-sq m (1/200-acre) erosion plots was used to study erosion occurring on steep road fills constructed with granitic soil materials in the Idaho Batholith. Erosion data were collected for a 3 1/2-year period from 1969 through 1972. Erosion on bare control plots averaged 3.4 metric tons/sq km per day for water years 1970 through 1972. Erosion was reduced an average of 44% and 95% by tree planting and straw mulching, respectively. Daily erosion rates were consistently higher during summer periods than during snowfree winter periods, presumably because of greater rainfall energy during the summer. Dry creep accounted for at least 15% of the total annual erosion for the years sampled and was as high as 40% in 1971. The erodibility index was a poor predictor of erosion for rain periods. Observations in the area suggest that wind was an important erosion factor on the steep slope studied. The median particle size of eroded materials D sub 50 tended to decrease throughout the summer and fall until mid-October when it abruptly increased. Soil crusting during the summer and soil freezing and thawing in the fall may have caused these seasonal trends. (Lee-ISWS)
W78-09330

SEDIMENTATION RATES AND A REVISED SEDIMENT BUDGET FOR LAKE ERIE,
Canada Centre for Inland Waters, Burlington (Ontario).
A. L. W. Kemp, G. A. MacInnis, and N. S. Harper.
Journal of Great Lakes Research, Vol. 3, No. 3-4, p 221-233, December 1977. 4 fig, 4 tab, 31 ref.

Descriptors: *Lake Erie, *Deposition(Sediments), *Lakes, *Sedimentation rates, *Great Lakes, On-site investigations, Surveys, Sediments, Erosion, Shores, Sediment loads, Rivers, Sampling, On-site data collections, Palynology, Dating, Pollen, Distribution patterns, Sediment distribution, Analysis, Methodology, *Sediment budget, Sediment sources, Shoreline bluff erosion, Pinus pollen, Ambrosia pollen.

Present-day sedimentation rates were determined at 50 offshore locations, representative of the depositional basins of Lake Erie. Sedimentation rates were calculated by averaging the weight of sediment above the Ambrosia and/or Pinus pollen horizons, dated at 1850. The rates are variable, ranging from a low of 0 g/sq m/yr to a maximum value of 6,450 g/sq m/yr. Sedimentation rates were highest in the western basin, near the mouths of the Detroit and Maumee Rivers, and in the deepest parts of the eastern basin, east of Long Point. The high rates in the western basin are due to the large inputs of suspended solids from the Detroit and Maumee Rivers. Erosion of shoreline bluffs between Rondeau and Long Point probably is responsible for the high rates in the eastern basin. Mean sedimentation rates of 2,160, 580, and 1,340 g/sq m/yr were calculated for the western, central, and eastern basins, respectively. A total of 14.3 million tons of fine-grained sediment is deposited annually in the lake. Erosion of shoreline bluffs is the major source of the sediment that is accumulating in the offshore basins, accounting for 40% of all incoming materials. Rivers are the second largest source, contributing 28% of the external sediment load. (Humphreys-ISWS)
W78-09339

APPLICATION OF DIGESTED SLUDGE FOR IMPROVING ERODED SOIL CAUSED BY SO2,
Chinese Univ. of Hong Kong. Dept. of Biology.
For primary bibliographic entry see Field 5E.
W78-09420

CONTROL OF SEDIMENTS, NUTRIENTS, AND ADSORBED BIOCIDES IN SURFACE IRRIGATION RETURN FLOWS,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 5G.
W78-09450

SHORELINE EROSION IN SOUTHEASTERN WISCONSIN,
Wisconsin Geological and Natural History Survey, Madison.
D. W. Hadley.
Special Report No. 5, February 1976. 33 p, 17 fig, 9 ref.

Descriptors: *Wisconsin, *Lake Michigan, *Shoreline erosion, *Erosion control, *Slope stabilization, *Coastal engineering, Lake shores, Shore protection, Beach erosion, Waves(Water), Littoral drift, Currents(Water), Coastal structures, Coasts, Groundwater, Water level fluctuations, Ice, Geologic history, Geology, Glacial sediments, Costs, Landslides.

The highly developed Lake Michigan shoreline in southeastern Wisconsin has experienced accelerated erosion in recent years, due in part to unusually high precipitation and near-record high-water levels. This report describes natural processes involved, geologic history, and possible remedial measures. Much of the shore is composed of high, steep bluffs developed in loose, unconsolidated silt, sand, gravel, and clay of glacial origin. Recent erosion at the foot of the bluffs from storm waves has resulted in numerous landslides and danger to homes and residents. The situation is further aggravated by groundwater seepage from the bluffs. Alternatives to relocation of dwellings or inaction are costly, and include: (1) slope stabilization, (2) construction of permanent protective structures, and (3) temporary protection. Several measures may be required on a single property. As very few attempts by individual owners to protect isolated property have been successful, community effort is almost essential. Before protective structures can be built where massive slumping is likely, regrading the slope is necessary. If spring sapping is significant, adequate drainage structures must be provided. To prevent gully erosion, devegetated areas must be replanted and surface runoff controlled. Slope stabilization measures include retaining structures at the base, drains to lower the water table, and regrading. (Lynch-Wisconsin)
W78-09547

TRACE METAL CONCENTRATIONS IN ESTUARINE SEDIMENTS: MOBILIZATION, MIXING OR PRECIPITATION,
Waterloopkundig Lab., Delft (Netherlands).
For primary bibliographic entry see Field 5B.
W78-09601

FLUVIAL SEDIMENT IN OHIO,
Geological Survey, Lansing, MI. Water Resources Div.; and Geological Suvey, Columbus, OH Water Resources Div.
P. W. Anttila, and R. L. Tobin.
Available from Supt. of Document, GPO, Washington, DC, 20402; price $2.30. Water-Supply Paper 2045, 1978. 57 p, 20 fig, 17 tab, 28 ref.

Descriptors: *Fluvial sediments, *Sediment transport, *Sediment yield, *Ohio, *Streams, Streamflow, Flow rates, Sediment discharge, Suspended load, Bed load, Particle size, Data collections, Stations, Regional analysis, Evaluation.

Characteristics of fluvial sediment in Ohio streams and estimates of sediment yield are based on data from several daily record stations and 5 years of intermittent record from a 38-station network. Most of the sediment transported by Ohio streams is in suspension. Mean annual bedload discharge, in percentage of mean annual suspended-sediment discharge, is estimated to be less than 10 percent at all but one of the sediment stations analyzed. Duration analysis shows that about 90 percent of the suspended sediment averages less than 100 mg/liter 75 percent of the time and less than 50 mg/liter 50 percent of the time. Suspended sediment in Ohio streams is composed mostly of silt and clay. Sand particle content ranges from 1 to 2 percent in northwestern Ohio to 15 percent in the east and southeast. Sediment yields range from less than 100 tons per square mile per year in the northwest corner of Ohio to over 500 tons per square mile per year in the southern part, in Todd Fork basin, lower Paint Creek basin, and the Kentucky Bluegrass area. Yield from about 63 percent of Ohio's land area ranges from 100 to 200 tons per square mile per year. (Woodard-USGS)
W78-09742

SEDIMENT DISCHARGE FROM HIGHWAY CONSTRUCTION NEAR PORT CARBON, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W78-09750

PREDICTION OF SEDIMENT TRANSPORT IN A GRASSED MEDIA,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4D.
W78-09764

COMPARATIVE ERODIBILITY OF LOESS SOILS IN POLAND AND THE UNITED STATES,
Agricultural Research Service, Columbia, MO. North Central Watershed Research Center.
For primary bibliographic entry see Field 4D.
W78-09766

EVALUATION OF WILD OAT STRAW AS A SOIL EROSION RETARDANT USING SIMULATED RAINFALL,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 4D.
W78-09784

2K. Chemical Processes

EXCHANGEABLE SODIUM AND SOIL WATER BEHAVIOR UNDER FIELD CONDITIONS,
Central Soil Salinity Research Inst., Karnal (India).
For primary bibliographic entry see Field 2G.
W78-09329

ANALYTICAL IMPLICATIONS OF HARMONIZED MONITORING SCHEMES,
Water Research Centre, Medmenham (England). Water Quality and Health Div.
For primary bibliographic entry see Field 5A.
W78-09331

COLLABORATIVE TESTING OF A MANUAL SODIUM ARSENITE METHOD FOR MEASUREMENT OF NITROGEN DIOXIDE IN AMBIENT AIR,
Environmental Monitoring and Support Lab., Research Triangle Park, NC.
For primary bibliographic entry see Field 5A.
W78-09332

ANALYZER FOR CONTINUOUS DETERMINATION OF DISSOLVED OXYGEN, PH, ELECTRICAL CONDUCTIVITY, TEMPERATURE, AND TRANSPARENCY IN NATURAL WATERS,
Akademiya Nauk SSSR, Moscow. Inst. Geokhimii i Analiticheskoi Khimii.
For primary bibliographic entry see Field 5A.
W78-09338

THE ROLE OF STANDARD REFERENCE MATERIALS IN ENVIRONMENTAL MEASUREMENTS,
National Bureau of Standards, Washington, DC.
For primary bibliographic entry see Field 5A.
W78-09361

ATMOSPHERIC SCAVENGING OF HYDROCHLORIC ACID,
Illinois Inst. of Tech. Research Inst. Chicago.
For primary bibliographic entry see Field 5A.
W78-09362

ANION MOBILITY IN SOILS: RELEVANCE TO NUTRIENT TRANSPORT FROM TERRESTRIAL TO AQUATIC ECOSYSTEMS,
Washington Univ., Seattle. Coll. of Forest Resources.
For primary bibliographic entry see Field 5B.
W78-09442

FRAZIL-ICE NUCLEATION BY MASS-EXCHANGE PROCESSES AT THE AIR-WATER INTERFACE,
Alaska Univ., College. Geophysical Inst.
For primary bibliographic entry see Field 2C.
W78-09648

THE SOLUBILITIES OF CARBONATES AND PHOSPHATES IN CALCAREOUS SOIL SUSPENSIONS,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
G. M. Marion, and K. L. Babcock.
Soil Science Society of America Journal, Vol. 41, No. 4, p 724-728, July-August, 1977. 6 tab, 4 fig, 36 ref.

Descriptors: *Soil water, *Soil chemical properties, *Carbonates, *Phosphates, *Solubility, *Calcareous soil, Calcite, Calcium compounds, X-ray diffraction, Ions, Suspension.

Solubility of salts in irrigated soils is an extensively researched and important field in the arid lands agriculture of the Southwest U.S. This paper evaluates the significance of ion-pairs on carbonate and phosphate activity in calcareous soils, and identifies the solid phases governing their solubility in calcareous soils tested including Altamont, Clear Lake, and Panoche. Up to 50 percent of the soluble phosphate was found present as ion-pairs in calcite under-saturated and supersaturated experiments. Calcite was the only carbonate mineral identified by X-ray diffraction, with calcium phosphate minerals most likely present in the soils. Experimental data is tabulated and graphed. (Popkin-Arizona)
W78-09711

FITTING SOLUTE BREAKTHROUGH EQUATIONS TO DATA USING TWO ADJUSTABLE PARAMETERS,
California Univ., Berkeley. Dept. of Soils and Plant Nutrition.
For primary bibliographic entry see Field 2G.
W78-09715

GROUND-WATER BASIC DATA FOR DICKEY AND LA MOURE COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09743

HYDROLOGIC DATA FOR MOUNTAIN CREEK, TRINITY RIVER BASIN, TEXAS, 1976,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09751

HYDROGEOLOGY OF THE OBSERVATION WELL SITE AT THE U.S. GEOLOGICAL SURVEY NATIONAL CENTER, RESTON, VIRGINIA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W78-09757

2L. Estuaries

APPLICATION OF AN OIL SPILL VULNERABILITY INDEX TO THE SHORELINE OF LOWER COOK INLET, ALASKA,
South Carolina Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W78-09301

STRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK OF PART OF THE COASTAL PLAIN OF TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W78-09310

LIMNOLOGY OF LAGUNA TORTUGUERO, PUERTO RICO,
Geological Survey, Fort Buchanan, PR. Water Resouces Div.
For primary bibliographic entry see Field 2H.
W78-09314

RELATION OF URBAN LAND-USE AND LAND-SURFACE CHARACTERISTICS TO QUANTITY AND QUALITY OF STORM RUNOFF IN TWO BASINS IN CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W78-09321

TRANSFERS ACROSS AN AIR-WATER INTERFACE AT HIGH WIND SPEEDS: THE EFFECT OF SPRAY,
Stanford Univ., CA. Dept. of Civil Engineering.
C. S. Wang, and R. L. Street.
Journal of Geophysical Research, Vol. 83, No. C6, p 2959-2969, June 20, 1978. 12 fig, 3 tab, 31 ref. NSF ATM73-06538.

Descriptors: *Air-water interfaces, *Winds, *Sea spray, *Energy transfer, Laboratory tests, Model studies, Hydraulic models, Instrumentation, Equipment, Drops(Fluids), Analysis techniques, Data processing, Heat transfer, Evaporation, Heat, Energy, Interfaces, Oceanography, Meteorology.

The generation of spray under high wind speed conditions has been investigated in a laboratory wind, water wave research facility. An electrostatic capacitance wire probe system was used to measure spray. Mean energy transfers were determined by a standard boundary layer integral technique. For a given wind velocity, the spray concentration decreases logarithmically with increased distance from the mean water surface. The spray concentration and distribution results of this study are consistent with field and other laboratory studies (with one exception). While wave breaking, whitecapping, and bubble bursting during spray formation contribute to increased interface roughness, calculations based on the laboratory data showed that the latent and sensible heat transfers from the spray drops make a negligible contribution to the energy transfer observed. The marked increase in measured energy transport under spray conditions is due almost entirely to increased transfer from the roughened interface (there is a linear correlation between the latent and total heat transfers and the root-mean-square water surface displacement). However, extrapolation of the laboratory results suggested strongly that spray drops make a significant contribution to the energy transfer in field situations with wind, temperature, and humidity conditions equivalent to those in the laboratory because of greatly increased droplet boundary layer thicknesses in the field. (Sims-ISWS)
W78-09341

BREAKING INVARIANTS IN SHOALING WAVES,
Scripps Institution of Oceanography, La Jolla, CA.
W. G. Van Dorn.
Journal of Geophysical Research, Vol. 83, No. C6, p 2981-2988, June 20, 1978. 10 fig, 1 tab, 24 ref. ONR N0014-69-A-0200-6012.

Descriptors: *Waves(Water), *Ocean waves, *Shoals, Laboratory tests, Shallow water, Shores, Energy, Wavelengths, Velocity, Depth, Oceans, Oceanography, *Wave kinematics, Breaking waves.

The inability of present theory to describe correctly the shoaling transformation of surface gravity waves is well recognized. It owes, at least in part, to the lack of experimental information on internal flow fields. This paper described a portion of the results from laboratory experiments in which the time histories of surface elevation, crest speed, and horizontal subsurface flow velocities in trains of uniform waves were measured at a plurality of stations before and after breaking, as functions of (uniform) beach slope and wave frequency. It was found that over gentle slopes, wave breaking is characterized by invariancy of crest profiles and kinematics and that most important breaking parameters can be expressed in terms of period and breaker height, the latter of which appears to be related simply to deepwater height and steepness. (Sims-ISWS)
W78-09342

TESTS OF LOW-DENSITY MARINE LIMESTONE FOR USE IN BREAKWATERS,
Coastal Engineering Research, Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 8B.
W78-09360

FLOAT TETHER TERMINATOR,
For primary bibliographic entry see Field 8B.
W78-09429

BREAKWATER STABILITY STUDY, IMPERIAL BEACH, CALIFORNIA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 8B.
W78-09469

DOLOS ARMOR UNITS USED ON RUBBLE-MOUND BREAKWATER TRUNKS SUBJECTED TO NONBREAKING WAVES WITH NO OVERTOPPING,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 8B.
W78-09470

FIELD STUDY OF THE EFFECTS OF STORMS ON THE STABILITY AND FATE OF DREDGED MATERIAL IN SUBAQUEOUS DISPOSAL AREAS,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5E.
W78-09471

FEASIBILITY OF PINTO ISLAND AS A LONG-TERM DREDGED MATERIAL DISPOSAL SITE,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5E.
W78-09474

PORT ONTARIO HARBOR, NEW YORK, DESIGN FOR WAVE PROTECTION AND PREVENTION OF SHOALING; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 8B.
W78-09475

COMPARISON OF NUMERICAL AND PHYSICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA,
Coastal Engineering Research Center, Fort Belvoir, VA.
D. L. Harris, and B. R. Bodine.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 795, Price codes: A09 in paper copy, A01 in microfiche. General Investigation of Tidal Inlets (Joint program of Army Coastal Engineering Research Center, Fort Belvoir, Va, and Army Engineer Waterways Experiment Stations, Vicksburg, MS) GITI Report 6, June 1977. 195 p, 2 tab, 52 fig, 3 append, 73 ref.

Descriptors: *Hydraulic models, *Mathematical models, *Model studies, , North Carolina, *Masonboro Inlet(NC), *Tidal inlets, *Simulation analysis.

Four models of Masonboro Inlet, North Carolina, have been developed in a program for assessing the value of models in investigating coastal inlet hydraulics problems. A distorted scale, fixed-bed physical model, a lumped parameter numerical model, and two two-dimensional numerical models were included in the study. Equations are used to investigate the correspondence between model flows. This analysis shows that it should be possible to simulate the major aspects of tidal flow about equally well with either physical or numerical models, that physical models should be most useful for investigating the interaction of the flow of primary importance with boundary conditions or with flows of smaller scale, and that numerical models should be most useful for investigating the interaction between the flow of primary importance and larger scale or external phenomena such as the effects of storms and of the earth's rotation. The assumptions employed in the derivation of the equations used with the lumped parameter model were found to be more restrictive in application than originally supossed. New equations are presented which display these assumptions more clearly. (See W78-09478 thru W78-09481) (WES)
W78-09477

COMPARISON OF NUMERICAL AND PHYSICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA; APPENDIX 1: FIXED-BED HYDRAULIC MODEL RESULTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
R. A. Sager, and W. C. Seabergh.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 796, Price codes: A04 in paper copy, A01 in microfiche. General Investigation of Tidal Inlets (Joint program of Army Coastal Engineering Research Center, Fort Belvoir, VA. and Army Engineer Waterways Experiment Station, Vicksburg, Miss.) GITI Report 6, App 1, June 1977. 69 p, 6 photos, 33 pl.

Descriptors: *Model studies, *Hydraulic models, *Mathematical models, North Carolina, *Masonboro Inlet(NC), *Tidal inlets, *Fixed-bed models, *Simulation analysis.

This appendix discusses the verification, base tests, and predictive test of a fixed-bed hydraulic model of Masonboro Inlet, N. C., as part of the evaluation of the state-of-the-art inlet modeling techniques. It presents the data necessaryf for a comparison of results of the physical and numerical models discussed in the basic report and in Appendices 2-4. Further information concerning the physical fixed-bed model of which this report is a summary can be found in the reports 'Physical Model Simulation of the Hydraulics of Masonboro Inlet, N. C.' (in preparation), and 'Supplementary Tests of Masonboro Inlet Fixed-Bed Model' (in preparation). (See also W78-09477) (WES)
W78-09478

COMPARISON OF NUMERICAL AND PHYSICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA; APPENDIX 2, NUMERICAL SIMULATION OF HYDRODYNAMICS (WRE),
Water Resources Engineers, Inc., Austin, TX.
F. D. Masch, R. J. Brandes, and J. D. Reagan.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 797, Price codes: A09 in paper copy, A01 in microfiche. General Investigation of Tidal Inlets (Joint program of Army Coastal Eng Res Ctr, Ft Belvoir, VA, and Army Engineer Waterways Experiment Station, Vicksburg, Miss) GITI Report 6, App 2, Vol 1-2, Jun 77. 343 p, 65 fig, 11 tab, 10 ref.

Descriptors: Hydrodynamics, *Hydraulic models, *Mathematical models, North Carolina, *Tidal inlets, *Masonboro Inlet(NC), Finite difference method, *Simulation analysis.

A two-dimensional finite difference tidal hydrodynamics model has been adapted to Masonboro Inlet, North Carolina. The model was initially calibrated to simulate prototype conditions of September and October 1969. Operational runs were then undertaken to simulate tides and currents corresponding to pre-project undeveloped inlet conditions of November 1964 and modified inlet and north jetty conditions of June 1967. For each case, the model was operated with mean and spring ocean tides. The tidal hydrodynamics model applied at Masonboro Inlet uses an explicit numerical solution of the basic equations of motion and the continuity equation. As structured, the model includes bathymetric data for the inlet, bottom roughness, inundated areas and other features of the system. Because of the size and detail required in the simulations, a dual-model approach is employed. (See also W78-09477) (WES)
W78-09479

COMPARISON OF NUMERICAL AND PHYSICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA: APPENDIX 3, NUMERICAL SIMULATION OF HYDRODYNAMICS (TRACOR),
Coastal Engineering Research Center, Fort Belvoir, VA.
R. J. Chen, and L. A. Hembree, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 799, Price codes: A13 in paper copy, A01 in microfiche. General Investigation of Tidal Inlets (Joint program of Army Coastal Engineering Research Center, Fort Belvoir, VA, and Army Engineer Waterways Experiment Station, Vicksburg, Miss) GITI Report 6, App 3, June 1977. 253 p, 1 app, 63 fig, 18 tab, 15 ref.

Descriptors: Hydrodynamics, *Hydraulic models, *Mathematical models, *North Carolina, *Masonboro Inlet(NC), *Tidal inlets, Tidal flats, *Simulation analysis.

The purpose of this project to modify an existing two-dimensional numerical hydrodynamic model to be applied to Masonboro Inlet, North Carolina. The model essentially consists of a numerical solution to the time-dependent linearized shallow-water equation. One of the modifications was the incorporation of tidal flats which are important in the Masonboro Inlet system. The second was to devise a procedure for handling open water boundaries at which no boundary conditions were available. Using data for September 1969 supplied by CERC, the friction factor was adjusted to simulate the observed tide stage variation. Satisfactory verification was obtained against tidal stage variation and intratidal current phasing. The magnitude of the computed currents were consistently small but this is not thought to seriously delimit the model's utility. (See also W78-09477) (WES)
W78-09480

COMPARISON OF NUMERICAL AND PHYSICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA; APPENDIX 4, SIMPLIFIED NUMERICAL (LUMPED PARAMETER) SIMULATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
C. J. Huval, and G. L. Wintergerst.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 800, Price codes: A06 in paper copy, A01 in microfiche. General Investigation of Tidal Inlets (Joint program of Army Coastal Engineering Research Center, Fort Belvoir, VA, and Army Engineer Waterways Experiment Station, Vicksburg, Miss) GITI Report 6, App 4, June 1977. 115 p, 4 app, 15 tab, 24 fig, 20 ref.

Descriptors: *Hydraulic models, *Mathematical models, North Carolina, *Tidal inlets, *Masonboro Inlet(NC), *Lumped parameter approach.

This report summarizes a mathematical model study of water motions in two horizontal dimensions for Masonboro Inlet, North Carolina. The study was part of the Corps of Engineers' General Investigation of Tidal Inlets research program

(GITI) and was designed to meet two primary objectives. The first objective was to evaluate the effectiveness of state-of-the-art physical and mathematical modeling techniques in predicting the effects of major changes to an inlet on the hydraulics of the inlet. A second objective was to determine whether simple model tests, performed quickly and for a reasonable cost, could be relied on to evaluate the design of inlet improvements. The mathematical and physical models were initially calibrated using bathymetric and hydraulic data collected at the inlet in September 1969. Selected parts of the calibrated model were subsequently remolded for prediction of hydraulic characteristics for the following conditions: (1) preproject undeveloped inlet conditions, November 1964 bathymetry; and (2) modified inlet and north jetty conditions, July 1966 bathymetry. Results of the mathematical model investigations are discussed. (See also W78-09477) (WES)
W78-09481

AQUATIC DISPOSAL FIELD INVESTIGATION, GALVESTON, TEXAS, OFFSHORE DISPOSAL SITE; APPENDIX A: INVESTIGATION OF THE HYDRAULIC REGIME AND PHYSICAL NATURE OF SEDIMENTATION,
Moody Coll. of Marine Sciences and Maritime Research, Galveston, TX. Dept. of Marine Sciences.
For primary bibliographic entry see Field 5E.
W78-09482

AQUATIC DISPOSAL FIELD INVESTIGATION, GALVESTON, TEXAS, OFFSHORE DISPOSAL SITE; APPENDIX B: INVESTIGATION OF WATER-QUALITY PARAMETERS AND PHYSICOCHEMICAL PARAMETERS,
Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.
For primary bibliographic entry see Field 5E.
W78-09483

AQUATIC DISPOSAL FIELD INVESTIGATIONS, COLUMBIA RIVER DISPOSAL SITE, OREGON; APPENDIX A: INVESTIGATION OF THE HYDRAULIC REGIME AND PHYSICAL NATURE OF BOTTOM SEDIMENTATION,
Washington Univ., Seattle. Dept. of Oceanography.
For primary bibliographic entry see Field 5E.
W78-09484

AQUATIC DISPOSAL FIELD INVESTIGATIONS, DUWAMISH WATERWAY DISPOSAL SITE, PUGET SOUND, WASHINGTON; APPENDIX C: EFFECTS OF DREDGED MATERIAL DISPOSAL ON THE CONCENTRATION OF MERCURY AND CHROMIUM IN SEVERAL SPECIES OF MARINE ANIMALS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
For primary bibliographic entry see Field 5E.
W78-09485

AQUATIC DISPOSAL FIELD INVESTIGATIONS, EATONS NECK DISPOSAL SITE, LONG ISLAND SOUND; APPENDIX B: WATER-QUALITY PARAMETERS AND PHYSICOCHEMICAL SEDIMENT PARAMETERS.
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5E.
W78-09486

AQUATIC DISPOSAL FIELD INVESTIGATIONS, EATONS NECK DISPOSAL SITE, LONG ISLAND SOUND; APPENDIX C: PREDISPOSAL BASELINE CONDITIONS OF BENTHIC ASSEMBLAGES,
New York Ocean Science Lab., Montauk.
For primary bibliographic entry see Field 5E.
W78-09487

DEVELOPMENT OF A MATHEMATICAL WATER QUALITY MODEL FOR GRAYS HARBOR AND THE CHEHALIS RIVER, WASHINGTON.
Battelle Pacific Northwest Lab., Richland, WA.
For primary bibliographic entry see Field 5B.
W78-09518

FOOD-CHAIN RELATIONSHIPS IN SUBTIDAL SILTY SAND MARINE SEDIMENTS AND THE ROLE OF MEIOFAUNA IN STIMULATING BACTERIAL PRODUCTIVITY,
Institut fur Meeresforschung, Bremerhaven (West Germany).
For primary bibliographic entry see Field 6G.
W78-09578

WATER MOVEMENT AND SEASONAL ALGAL GROWTH IN HAWAII,
Hawaii Univ., Honolulu. Dept. of Botany.
B. Santelices.
Marine Biology, Vol 43, No 3, 1977, p 225-235, 7 fig, 2 tab, 40 ref.

Descriptors: Environment, Aquatic environment, *Algae, Distribution, Sea water, *Seasonal, Light, Temperature, Salinity, *Hawaii, Algal growth.

This study was undertaken to search for the presence of groups of ecological species on a tropical shore, to evaluate the importance of water movement on the structuring of shallow-water tropical algal communities, and to describe seasonal changes of algal floras in a tropical reef. The environmental parameters measured were light, temperature, water movement, and salinity. An observed pattern of decrease of biomass during July-September and maximum biomass in February-May did not show any significant correlation with any of these parameters except that the period of minimum biomass coincided with the period of maximum water movement. Four groups of ecological species emerged during the study; one had positive correlations with light intensity and negative correlations with water movement; a second had the opposite trend; a third showed an irregular pattern of distribution throughout the year; and a fourth showed an irregular annual cycle which did not correlate with any of the parameters but did correlate with another species of the same genus. It was concluded that all species studied had horizontal changes of biomass throughout the year which correlated with horizontal and seasonal changes of water movement on the reef. (Chilton-ORNL)
W78-09583

METALS IN AN ACID MINE STREAM AND ESTUARY,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
For primary bibliographic entry see Field 5B.
W78-09596

SEASONAL AND VERTICAL DISTRIBUTION AND GROWTH OF JUVENILE AND ADULT CAPELIN (MALLOTUS VILLOSUS) IN THE ST. LAWRENCE ESTUARY AND WESTERN GULF OF ST. LAWRENCE,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 6G.
W78-09597

TRACE METAL CONCENTRATIONS IN ESTUARINE SEDIMENTS: MOBILIZATION, MIXING OR PRECIPITATION,
Waterloopkundig Lab., Delft (Netherlands).
For primary bibliographic entry see Field 5B.
W78-09601

MARINE DYNAMICS AND ITS EFFECTS ON CURRENT MEASURING TRANSDUCERS,
National Oceanic and Atmospheric Administration, Sterling, VA.
For primary bibliographic entry see Field 7B.
W78-09651

SUSCEPTIBILITY OF COASTAL PLAIN AQUIFERS TO CONTAMINATION, FAIRFAX COUNTY, VIRGINIA, A COMPUTER COMPOSITE MAP,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09735

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

COLORADO RIVER DESALINIZATION, WILD DUCK STUDY,
Colorado State Univ., Fort Collins, Dept. of Physiology and Biophysics.
For primary bibliographic entry see Field 5G.
W78-09799

3B. Water Yield Improvement

CHARACTERISTICS OF ARIZONA PONDEROSA PINE STANDS ON SANDSTONE SOILS,
Arizona Univ., Tucson.
P. F. Ffolliott, and M. B. Baker, Jr.
Department of Agriculture, Forest Service, Ft. Collins, Colo., Rocky Mt. Forest and Range Experiment Station, General Technical Report RM-44, 7 p, November, 1977. 2 fig, 20 ref, 1 tab.

Descriptors: *Forest soils, *Sandstones, *Soil water, *Water yield, Sedimentary rocks, Igneous rocks, Arizona, Pine trees, Ponderosa pine trees, Soil types.

Limited information is available for ponderosa pine (Pinus ponderosa) forest types growing on sedimentary-derived soils. Based on a 4-year study of ponderosa pine watersheds on sedimentary soils, annual water yield is about 25% of that from volcanic soils, herbage production is lower even though forest densities are less, and forest site index is higher. (Witt-IPC)
W78-09528

THE WELLTON-MOHAWK: WHERE NECESSITY IS TEACHING THEM TO SAVE WATER,
R. Ross.
Irrigation Age, Vol 11, No 8, p 30, May-June, 1977. 1 fig.

Descriptors: *Water conservation, Irrigation effects, Salinity, Saline water, Mexico.

In 1973, an agreement was signed between Mexico and the United States that could have far reaching influences on how southwestern American farmers irrigate. Leaders of the two nations signed documents which said that by a given date, the level of salts in the Colorado River, as it enters Mexico, would be held to certain 'reasonable' limits. Reaching those limits will require new irrigation technology in the 64,000-acre Wellton-Mohawk Irrigation and Drainage District, east of Yuma, Arizona. And what those farmers learn, to satisfy the agreement, could be applicable to many other arid areas within the United States and worldwide, as water and energy demands increase. (Skogerboe-Colorado State)
W78-09668

SOIL-ASPHALT MIXTURE FOR CANAL SEEPAGE CONTROL: LABORATORY STUDY,
Department of Agriculture, Lethbridge (Alberta). Research Station.
For primary bibliographic entry see Field 4A.
W78-09787

3C. Use Of Water Of Impaired Quality

EFFECTS OF IRRIGATION ON WATER QUALITY IN THE SAND PLAIN OF CENTRAL WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 5B.
W78-09306

EXCHANGEABLE SODIUM AND SOIL WATER BEHAVIOR UNDER FIELD CONDITIONS,
Central Soil Salinity Research Inst., Karnal (India).
For primary bibliographic entry see Field 2G.
W78-09329

NO SIMPLE ANSWERS ON SALINITY,
For primary bibliographic entry see Field 5G.
W78-09666

THE WELLTON-MOHAWK: WHERE NECESSITY IS TEACHING THEM TO SAVE WATER,
For primary bibliographic entry see Field 3B.
W78-09668

CONTRIBUTION TO THE MICROMORPHOLOGY OF SOME SALINE SOILS OF THE NORTH NILE DELTA IN EGYPT,
National Research Centre, Cairo (Egypt). Soils Lab.
For primary bibliographic entry see Field 2G.
W78-09719

CLAY IN RELATION TO PEDALITY AND STABILITY OF MICROSTRUCTURE IN NILE ALLUVIAL SOILS,
Cairo Univ., Giza (Egypt). Dept. of Soils.
For primary bibliographic entry see Field 2G.
W78-09722

OBSERVATIONS OF SOIL WATER AND SALT MOVEMENT UNDER DRIP AND FLOOD IRRIGATION IN AN APPLE ORCHARD,
Commonwealth Scientific and Industrial Research Organization, Merbein (Australia). Div. of Horticultural Research.
J. G. Obbink, and D. M. Alexander.
Agricultural Water Management, Vol. 1, No. 2, p 179-190, September, 1977. 4 fig, 3 tab, 10 ref.

Descriptors: Soil water, *Soil water movement, *Soil moisture, Salts, Salinity, *Saline soils, *Flood irrigation, Surface irrigation, Irrigation practices, Irrigation systems, Orchards, Apples, Crop response, *Drip irrigation.

Part of a mature apple orchard, previously flood irrigated, was converted to drip irrigation in August 1971 and maintained until May 1975. The remainder of the orchard was irrigated as before. Annual estimates were made of moisture, total soluble salts and chloride content of soil samples and of growth, leaf chloride and yield of trees from the two irrigation treatments. Soil moisture was also monitored with a neutron moisture meter. Very high salt concentrations were observed in the various soil layers in the drip irrigation treatment. The flood irrigation treatment had lower and less variable concentrations of salts. Yields and chloride content of leaves sampled each January did not differ significantly between treatments. Tree girths were smaller under drip irrigation. The drip system, using a low pressure head, filtered water and outlets wrapped in fiberglass, operated satisfactorily for the period of the trail. (Skogerboe-Colorado State)
W78-09762

FIELD MEASUREMENTS OF AMMONIA VOLATILIZATION FROM SURFACE APPLICATIONS OF AMMONIUM SALTS TO A CALCAREOUS SOIL,
Agricultural Research Service, Temple, TX. Blackland Conservation Research Center.
For primary bibliographic entry see Field 5B.
W78-09794

3D. Conservation In Domestic and Municipal Use

STATE'S RIGHTS REVISITED: THE NINTH CIRCUIT LEADS THE BUREAU OF RECLAMATION TO WATER.
For primary bibliographic entry see Field 6E.
W78-09700

3E. Conservation In Industry

SYSTEMS CLOSING IN KRAFT PULP MILLS,
Swedish Forest Products Research lab., Stockholm.
For primary bibliographic entry see Field 5D.
W78-09488

TECHNICAL STATUS OF EFFLUENT-FREE SULFITE PULP MILLS (TECHNISCHER STAND DER ABWASSERFREI ARBEITENDEN SULFITZELLSTOFFABRIK),
Chemiefaser Lenzing AG. (Austria).
For primary bibliographic entry see Field 5D.
W78-09489

WATER AND ITS ROLE IN PAPERMAKING (WASSER UND SEINE ROLLE BEI DER PAPIERHERSTELLUNG),
Chemische Fabrik Pelzer und Roehrl, Mainz (West Germany).
J. Varka.
Das Papier, Vol 31, No 10A, p V17-V21, November, 1977. 3 fig, 30 ref. English summary.

Descriptors: Pulp and paper industry, *Industrial water, Hydrogen bonding, Temperature, Ions, Water reuse, Recycling, Water quality, Cations, Water properties, Salts, Chemical precipitation, Water temperature, *Pulp wastes, Industrial wastes, White water(Paper machines), Waste paper.

The properties of water depend on the degree of association of its molecules. Hydrogen bonding is influenced both qualitatively and quantitatively by temperature and the presence of ions. Increased recycling, both of white water and of waste paper, influences ion content and water quality and, hence, the production process. The negative consequences of increased concentrations of polyvalent cations and of large ions with a weak ionic field are discussed, with reference to stock preparation, refining, electrokinetic processes in stock suspensions and deposition of contaminating substances. Various possibilities are considered for eliminating the growth of salt concentrations and consequent production disturbances. These involve either reducing the amount of salts introduced or precipitating them as fillers on the paper web. (Ward-IPC)
W78-09495

START-UP AND OPERATION OF BIOLOGICAL TREATMENT PLANTS IN PAPER MILLS (INBETRIEBNAHME UND BETRIEB VON BIOLOGISCHEN KLAERANLAGEN IN PAPIERFABRIKEN),
For primary bibliographic entry see Field 5D.
W78-09498

POTENTIAL FOR WATER REUSE IN AN EGYPTIAN POULTRY PROCESSING PLANT,
Alexandria Univ. (Egypt). Higher Inst. of Public Health.
For primary bibliographic entry see Field 5D.
W78-09556

FATE OF AFLATOXIN B2 IN A TWO-STEP MICROBIAL RECOVERY SYSTEM FOR FOOD INDUSTRY WASTES,
Economics Lab., Inc., St. Paul, MN. Capsule Testing Labs.
For primary bibliographic entry see Field 5D.
W78-09558

WATER CONFLICTS FROM THE VIEWPOINT OF A REGULATION,
Utah State Engineers' Office, Salt Lake City.
D. C. Hansen.
*Relative rights, *Thermal conductivity, *Energy transfer, *Electric power, *Water allocation(Policy), Thermal properties, Thermal water, Geothermal studies, Legal aspects, Prior appropriation, Competing uses, Irrigation, Water utilization, Water shortage, Energy, Energy conversion, Electricity, Water resources development, Hydrologic budget, Hot springs, Geysers.

The potential for geothermal development in the western United States appears very good. However, the fact remains that water is the medium by which the heat energy is conveyed in a geothermal system. Thus, the interrelationship between the geothermal system and other hydrologic systems needs to be examined. Water availability may be the most potentially limiting factor of geothermal development in the west. For the west is an arid region and even the existing water supply has been, to a large extent appropriated. The effect on present water rights of any geothermal development is especially important because of the large quantities of water that would be consumptively used in the generation of electricity from geothermal sources. A complicating factor is that we do not yet have sufficient experience or knowledge to determine the extent of the effect that geothermal development would have on groundwater resources. The author advises installation of extensive monitoring systems to detect the extent of interference early in the development of the geothermal resources. Thereafter, decisions could be made relative to providing compensation for those injured. (Baumbach-Florida)
W78-09730

WATER FOR INDUSTRIAL DEVELOPMENT IN GEORGE, HANCOCK, PEARL RIVER, AND STONE COUNTIES, MISSISSIPPI,
Geological Survey, Nashville, TN. Water Resources Div.; and Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 6D.
W78-09744

GROUNDWATER WITHDRAWN FOR MUNICIPAL, INDUSTRIAL, AND IRRIGATION USE IN THE UPPER PEACE AND ALAFIA RIVER BASINS, WEST-CENTRAL FLORIDA, 1970-74,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W78-09755

3F. Conservation In Agriculture

SPEED GOVERNOR FOR IRRIGATION SYSTEM,
Wade (R. M.) and Co., Portland, OR. (Assignee).
G. Cornelius.
U.S. Patent No. 4,067,497, 9 p, 9 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 966, No. 2, p 571, January 10, 1978.

Descriptors: *Patents, *Irrigation, *Irrigation systems, *Irrigation efficiency, Irrigation practices, Flow control, Application equipment.

In an irrigation line supported by towers and rotatable about a central pivot, one tower, for example, the outermost tower, includes a governor system for providing that increased water flow is provided to the water motor driving that tower as that tower is driven up a grade, and decreased water flow is provided to the water motor driving that tower as the tower is driven down a grade, as compared to the water flow to the water motor as the tower is driven over generally level ground. Thus the invention provides a drive apparatus which compensates for unevenness in terrain to be irrigated so as to insure substantially even irrigation of the land. (Sinha-OEIS)
W78-09425

TOWER DRIVE MECHANISM FOR SELF-PROPELLED SPRINKLER SYSTEM,
Frontier Machinery, Inc., Walla Walla, WA. (Assignee).
R. T. Pringle, and K. R. Ames.
U.S. Patent No. 4,068,679, 6 p, 6 fig, 2 ref; Official Gazette of the United States Patent Office, Vol. 966, No. 3, p 960, January 17, 1978.

Descriptors: *Patents, *Irrigation, *Irrigation systems, Sprinkler irrigation, Irrigation efficiency, Application equipment, Water delivery, Self-propelled irrigation systems.

A tower drive mechanism is described for a self-propelled sprinkler system having a water conduit elevationally supported by spaced towers. Each tower has a frame with leg members extending downward and outward interconnecting with a cross axle tube. Tandem wheel assemblies are mounted on the frame adjacent respective ends of the axle tube. A single electric motor is connected to one of the wheel assemblies so that the drive shaft does not become entangled with field debris or vegetation. The wheel assemblies and the motor have their individual worm gear reduction boxes. (Sinha-OEIS)
W78-09430

OSCILLATING SPRINKLING DEVICE,
Etablissements Carpano and Pons (France). (Assignee).
M. Chauvigne.
U.S. Patent No. 4,069,976, 8 p, 8 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 966, No. 4, p 1395, January 24, 1978.

Descriptors: *Patents, *Irrigation, *Sprinkler irrigation, Irrigation practices, Irrigation efficiency, Flow control, Water delivery, Application equipment.

A device which enables the sprinkling of a liquid on a substantially rectangular surface, while ensuring a regular distribution is provided. The device comprises a rotary motor element, which may be a turbine, actuable by the pressure of a sprinkling liquid alternately in one direction of rotation or the other. An oscillating sprinkler element, permanently kinematically connected to the rotary driving element, pivots about an approximately horizontal axis alternately in one direction of rotation or the other according to the direction of rotation of the driving element. Means are provided for controlling the change of direction of the driving element so that the jet of liquid under pressure from a single supply duct alternates in first and second directions. (Sinha-OEIS)
W78-09437

INFLUENCE OF TRICKLE AND SURFACE IRRIGATION ON RETURN FLOW QUALITY,
New Mexico State Univ., University Park. Dept. of Agronomy.
For primary bibliographic entry see Field 5G.
W78-09443

ASSESSMENT OF IRRIGATION RETURN FLOW MODELS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 5B.
W78-09445

EFFECTS OF IRRIGATION METHODS ON GROUNDWATER POLLUTION BY NITRATES AND OTHER SOLUTES,
Texas A and M Univ., Lubbock. Agricultural Research and Extension Center.
For primary bibliographic entry see Field 5B.
W78-09446

NITRATE IN EFFLUENTS FROM IRRIGATED LANDS (ANNUAL REPORT),
California Univ., Berkeley.
For primary bibliographic entry see Field 5B.
W78-09447

PROCEEDINGS OF THE SOLAR IRRIGATION WORKSHOP, (1977).
Energy Research and Development, Albuquerque, NM. Sandia Labs.
Available from the National Technical Information Service, Springfield, VA 22161 as SAND 77-0992, Price codes: A04 in paper copy, A01 in microfiche. Workshop held in Albuquerque, New Mexico, July 7-8, 1977. 60 p. Published June 1977, as Report SAND 77-0992.

Descriptors: *Solar irrigation, Energy, *Pumps, *Pumping plants, Irrigation wells, *Irrigation efficiency, Economics, *Irrigation systems, Wind velocity, *Energy conversion.

The Energy and Research and Development Administration Solar Irrigation Workshop was structured to be a major vehicle for information dissemination and technology transfer. It covered a wide range of subject matter related to crop irrigation including current hardware, economics, experiments, and international requirements. Speakers represented manufacturers, ranchers, governmental entities, universities and research firms. An anticipated heterogeneous attendee population dictated a format of many brief presentations rather than fewer more detailed discussions. This was done to expose the participants to the various expert speakers and to give them a cursory introduction to their particular expertise. These proceedings reflect the same intent. They consist of one page abstracts for each presentation, a brief biographical sketch of each speaker and sources for further information on each subject. (Skogerboe-Colorado State)
W78-09448

SOLAR TECHNOLOGY APPLICATIONS: A LITERATURE REVIEW OF SOLAR THERMAL POWERED IRRIGATION SYSTEMS,
California Univ., Livermore. Lawrence Livermore Lab.
H. W. Newkirk.
Available from the National Technical Information Service, Springfield, VA 22161 as UCID-17510, Price codes: A02 in paper copy, A01 in microfiche. Report UCID-17510, June 1977. 18 p, 1 fig, 32 ref.

Descriptors: *Thermal power, Powerplants, *Irrigation systems, Pumping plants, Pumping, *Solar technology, Reviews, *Literature review.

A summary is presented of published information on solar thermal powered irrigation systems. It is a compilation of literature references and a survey of on-going work in this field. Much of the material outlined is tentative, rapidly changing, and highly variable in time and place. The information should therefore be considered a guide rather than a set of specifications and will be updated as additional information and references appear in the literature. (Skogerboe-Colorado State)
W78-09449

SOIL PROPERTIES AND IRRIGATION,
California Univ., Davis. Dept. of Land, Air and Water Resources.
D. W. Grimes.
In: Proceedings of the 1977 Annual Technical Conference, Irrigation for all Reasons, p 40-44, February 13-15, 1977. 2 fig, 3 tab, 8 ref.

Descriptors: Soils, *Soil properties, *Irrigation, Irrigation effects, Root development, Soil moisture, Soil water, Soil investigations, Soil environment, Soil physical properties, *Water management(Applied), *Decision making.

Consideration of all soil properties important to water management decisions is beyond the scope of this report. Emphasis is placed on some techniques for using water related properties of soils in management decisions and impedance characteristics that reduce effective plant root extension. (Skogerboe-Colorado State).
W78-09452

SELECTING THE SYSTEM FOR THE SITE,
oregon State Univ., Corvallis. Dept. of Agricultural Engineering.
M. N. Shearer.
In: Proceedings of the 1977 Annual Technical Conference, Irrigation fo all Reasons, p 45-49, February 13-15, 1977.

Descriptors: Irrigation, *Irrigation systems, *Irrigation practices, Soils, Soil properties, *Sites, Soil physical properties, Sprinkler irrigation, Infiltration, Soil texture, Climates.

The title suggests that something about the 'site' has considerable influence on the type of irrigation system that should be installed at a specific location. If we assume that this is true, we are confronted with the problem of identifying those characteristics which are significant. (Skogerboe-Colorado) State).
W78-09453

TRAFFIC COMPACTION AND IRRIGATION,
National Tillage Machinery Lab., Auburn, AL.
A. C. Trouse, Jr.
In: Proceedings of the 1977 Annual Technical Conference, Irrigation for all Reasons, p 50-53, February 13, 15, 1977. 1 tab.

Descriptors: *Irrigation, Irrigation practices, Irrigation effects, Soils, *Soil compaction, Soil moisture, Soil water, Crop production.

When traffic compaction is present, no amount of irrigation will guarantee superior crop yeilds. Neither will well irrigated fields guarantee top production when soils are only mildly compressed, a common, bur less recognized, situation on may farms today. If moisture is to increase crop production, it must be both available and readily retrievable when needed, by whatever its method of entry into the soil. (Skogerboe-Colorado State)
W78-09454

TAILORING YOUR SOIL FOR DRAINAGE AND IRRIGATION,
Purdue Univ., Lafayette, IN. Dept. of Agronomy.
W. H. Daniel.
In: Proceedings of the 1977 Annual Technical Conference, Irrigation For All Reasons, p 54-58, February 13-15, 1977.

Descriptors: *Irrigation, *Drainage, Irrigation effects, Drainage effects, Soils, Soil properties, Turf, Turf grasses, Irrigation design, *Irrigation efficiency.

In much of the world, one of the most evident limitations of climate is the lack of available water. The fantastic advancement of the irrigation industry has been matched by the creative ideas of current installations. In the management of fine turf areas, the reduction of the limitations has been the target for many turf managers. Irrigation improvements have given most turf managers excellent tools for the day by day application of water at preferred quantities, at preferred times and under uniform application conditions. A study of several 18-hole golf course irrigation designs reveals that the number of heads being used vary from 800 to 1200. These, when combined with satellites and controllers for individual operations of the valves and heads, become effective systems. Many, in fact, most turf areas are developed on existing natural soil. Obviously, this includes a wide variety of soil types, each having varying infiltration and drainage potentials. For intensely used turf areas, extensive soil modifications have evolved as systems of construction. Four of these - vertical trenching, sand bedding, Purr-wick and PAT systems should be of interest. (Skogerboe-Colorado State)
W78-09455

DRIP AS SUPPLEMENTAL IRRIGATION,
Trickl-Eez Co., St. Joseph, MI.
J. R. Nye.
In: Proceedings of the 1977 Annual Technical Conference, Irrigation for all Reasons, p 73-76, February 13-15, 1977.

Descriptors: *Supplemental irrigation, Irrigation systems, *Irrigation practices, Water conservation, Irrigation efficiency, *Drip irrigation.

The use of drip or trickle irrigation as a supplement to natural rainfall is finding increased usage throughout the Midwest, Eastern and Southern states. By using technology developed mainly in California and the other western states, where drip irrigation has found widespread use as an efficient labor saving method of irrigation, growers who have never irrigated befor are adapting it to orchards, vineyards, vegetable croplands, and it may even find usage in field crops. (Skogerboe-Colorado State).
W78-09456

FERTILIZATION WITH DRIP IRRIGATION: CONCJEPTS, PRACTICES AND PROBLEMS,
Agrispect, Inc., Riverside, CA.
L. Francis.
In: Proceedings of the 1977 Annual Technical Conference, Irrigation for all Reasons, p 80-15, 1977. 2 fig.

Descriptors: *Irrigation, Irrigation effects, Irrigation practices, *Fertilization, Fertilizers, Nutrients, *Drip irrigation.

Fertilizer needs of our crops can be largely applied by means of injection through the drip irrigation system, so long as the proper adjustment is used and the chemicals used are thoroughly understood. (Skogerboe-Colorado State).
W78-09457

PECULIARITIES OF DRIP IRRIGATION SYSTEM DESIGN,
Olson Engineering Systems, Indio, CA.
B. R. Olson, Jr.
In: Proceedings of the 1977 Annual Technical Conference, Irrigation for all Reasons, p 84-87, February 13-15, 1977.

Descriptors: Irrigation, *Irrigation systems, *Irrigation practices, Soils, Soil properties, Water conservation, Irrigation design, Sprinkler irrigation, *Drip irrigation.

Drip irrigation is generally considered as a point source application of water at a rate that does not exceed the basic intake rate of the soil. There are certain critieria or 'peculiarities' concerning drip irrigation system design as compared to sprinkler or surface irrigation systems. The design engineer is responsible for critically analyzing these criteria. (Skogerboe-Colorado State).
W78-09458

NITROGEN, CHLORIDE, AND WATER BALANCE WITH IRRIGATED RUSSET BURBANK POTATOES IN A SANDY SOIL,
Wisconsin Univ.-Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W78-09652

PHOTOSYNTHESIS OF SUGARBEETS UNDER N AND P STRESS: FIELD MEASUREMENTS AND CARBON BALANCE,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
J. W. Cary.
Agronomy Journal, Vol. 69, No. 5, p 739-744, September-October 1977. 7 fig, 1 tab, 10 ref.

Descriptors: Crop production, *Photosynthesis, *Sugarbeets, *Phosphorus, *Nitrogen, Carbon balance, Crop response, Nutrients, Fertilizers, Fertilization, Measurement.

Advances in crop management are limited by inability to recognize changes in growth resulting from short-term fluctuations in plant environment. Simple, rapid, and nondestructive methods are needed to indicate daily and hourly rates of growth under field conditions. Because plant carbon balance is one possible approach to this problem, CO2 gas exchange parameters were measured on Beta vulgaris leaves of field-grown plants to learn whether or not they might signal the onset of nitrogen and P stresses. The sugarbeets were grown on field plots of Portneuf silt loam soil and allowed to develop severe N and P stresses. Carbon dioxide exchange and stomatal resistance of intact plant leaves were measured with small leaf chambers during 1 minute periods. Leaf water potentials were also measured in the field with a hydraulic press. The CO2 compensation points, dark respiration, and osmotic pressures of excised leaf tissue were measured in the laboratory by standard methods. Photosynthesis per unit leaf area was reduced in advanced stages of N deficiency; however, none of the measurements satisfactorily indicated the onset of N or P stress because of heterogeneity between leaves. (Skogerboe-Colorado State)
W78-09653

ARID AND SEMI-ARID LANDS: PROBLEMS AND PROSPECTS,
Cairo Univ. Giza (Egypt).
For primary bibliographic entry see Field 6G.
W78-09655

ROLE OF CHANGES IN SOLUTE CONCENTRATION IN MAINTAINING FAVORABLE WATER BALANCE IN FIELD-GROWN COTTON,
California Univ., Davis. Dept. of Agronomy and Range Science.
J. M. Cutler, D. W. Rains, and R. S. Loomis.
Agronomy Journal, Vol. 69, No. 5, p 773-779, September-October 1977. 5 fig, 49 ref.

Descriptors: *Cotton, Crop response, *Soil water, Soil moisture, *Irrigation, Irrigation effects, Crop production, Agriculture.

Cotton shows various adaptive responses to water deficits, including alterations in cellular osmotic concentrations. The role of changes in solute concentration in maintaining favorable water balance in field-grown cotton was evaluated under wet and dry irrigation treatments. The experiments were conducted with a fine loamy mixed, calcareous thermic-Typic Torriorthents soil in a semi-arid environment. Leaf diffusive resistance, measured by a resistance porometer, was unaffected by leaf water potential while the typical response to light was maintained. Leaf blade elongation rate was less in plants with low leaf water potential. The rate was maximal in the early evening and depressed during the midday water potential minimum and at night. Some blade enlargement occurred during time intervals when leaf water potentials were as low as -19 to -23 bars. (Skogerboe-Colorado State)
W78-09658

SOIL CONSERVATION ON AGRICULTURAL LAND: THE CHALLENGE AHEAD,
Soil Conservation Service, Washington, DC.
R. M. Davis.
Journal of Soil and Water Conservation, Vol. 32, No. 1, p 5-8, January-February 1977. 5 ref.

Descriptors: *Agriculture, *Soil conservation, Soil management, Crop production, Erosion, Soil erosion, Water quality.

Agriculture is a dynamic industry. Its technology and economics change constantly. Within this dynamic framework, soil conservationists, for more than four decades now, have tried to keep one objective clearly in view: To bring about improved soil and water management through a voluntary, cooperative program with conservation districts and landusers. Today, soil conservationists still find themselves confronted by change and challenge. Some suggestions are made as to how public involvement can aid in solving these problems. (Skogerboe-Colorado State)
W78-09659

NEMATICIDE DISTRIBUTION UNDER A DRIP EMITTER,
Georgia Univ., Athens. Dept. of Agricultural Engineering.
P. M. Garvey, and J. L. Chesness.
Paper No. 77-2014 presented at the 1977 Annual Meeting of the American Society of Agricultural Engineers, June 26-29, 1977, Raleigh, North Carolina, 16 p, 3 fig, 3 tab, 17 ref.

Descriptors: *Nematocide, Soils, Soil properties, Irrigation, Irrigation effects, *Irrigation systems, *Path of pollutants, Water pollution, *Drip irrigation.

Distribution of nematicide in the soil when applied at different concentrations through a drip irrigation emitter was studied. Concentrations of 30, 800, and 1500 ppm were used and soil volumes exposed to lethal concentrations of the nematicide were determined for each. (Skogerboe-Colorado State)
W78-09660

DRIP AND SPRINKLER IRRIGATION OF CARROTS AND ONIONS,
Montana State Dept. of Health and Environmental Sciences, Helena. Subdivision Bureau.
J. D. Mehstad, and D. W. DeBoer.
Paper No. 77-2013 presented at the 1977 Annual Meeting of the American Society of Agricultural Engineers, June 26-29, 1977, Raleigh, North Carolina, 13 p, 1 fig, 6 tab, 8 ref.

Descriptors: *Carrots, *Onions, *Sprinkler irrigation, Irrigation systems, Irrigation, *Drip irrigation.

One carrot and two onion varieties were drip and sprinkler irrigated. Drip yields were greater than sprinkler yields when equal gross amounts of water were used. Drip onions and carrots were larger on the average than sprinkler onions and carrots. (Skogerboe-Colorado State)
W78-09661

TRICKLE IRRIGATION: PREVENTION OF CLOGGING,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
R. G. Gilbert, F. S. Nakayama, and D. A. Bucks.
Paper No. 77-2011 presented at the 1977 Annual Meeting of the American Society of Agricultural Engineers, June 26-29, 1977, Raleigh, North Carolina, 23 p, 4 fig, 3 tab, 17 ref.

Descriptors: *Clogging, Irrigation, Irrigation systems, Irrigation practices, Irrigation efficiency, Filtration, Sediment load, *Trickle irrigation, Colorado River, Irrigation water.

Cloggings of several types of trickle emitters delivering Colorado River irrigation water to mature citrus trees was prevented by a combination of filtration and chemical treatments, which removed suspended load, and controlled microbial slime development and precipitation of carbonates. (Skogerboe-Colorado State)
W78-09662

MANUFACTURING VARIATION OF EMITTERS IN TRICKLE IRRIGATION SYSTEMS,
Rain Bird Technical Services, Logan, UT.
K. Solomon.
Paper No. 77-2009 presented at the 1977 Annual Meeting of the American Society of Agricultural Engineers, June 26-29, 1977, Raleigh, North Carolina, 20 p, 4 fig, 4 tab, 9 ref.

Descriptors: *Irrigation systems, Uniformity, *Irrigation efficiency, Irrigation, Irrigation practices, *Trickle irrigation, *Emitters.

Emitter manufacturing variation is shown to significantly affect trickle system efficiencies. Values of the Coefficient of Manufacturing Variation are given for several emission devices. Emission rate distributions are shown for typical trickle system conditions, and are evaluated according to Emission Uniformity and Water Storage Efficiency concepts. (Skogerboe-Colorado State)
W78-09663

ECONOMICS OF CENTER PIVOT END GUNS,
Rain Bird Sprinkler Mfg. Corp., Logan, UT.
R. D. von Bernuth.
Paper No. 77-2008 presented at the Annual Meeting of the American Society of Agricultural Engineers, June 26-29, 1977, Raleigh, North Carolina, 9 p, 3 fig, 3 tab, 4 ref.

Descriptors: *Sprinkler irrigation, Economics, Irrigation practices, Irrigation engineering, Irrigation systems, *Center pivot sprinklers, Costs.

Gun type sprinkler used as 'end guns' on center pivots are a popular means of gaining additional irrigated acreage. Several economic factors factors which result from using 'end guns' should be considered before arriving at the conclusion to use one. (Skogerboe-Colorado State)
W78-09664

CENTER PIVOT END SPRINKLER PATTERN ANALYSIS AND SELECTION,
Rain Bird Technical Services, Logan, UT.
K. Solomon, and M. Kodama.
Paper No. 77-2007 presented at the 1977 Annual Meeting of the American Society of Agricultural Engineers, June 26-29, 1977, Raleigh, North Carolina, 24 p, 6 fig, 2 tab, 9 ref.

Descriptors: *Sprinkler irrigation, Irrigation efficiency, Irrigation engineering, *Irrigation design, Sprinklers, *Center pivot sprinklers.

Application patterns from center pivot end sprinklers are determined from stationary distribution curves and presented in generalized form. Criteria are defined for evaluating end sprinkler selections relative to efficient utilization of land, water, and energy resources. Procedures are given for relating sprinklers and machine variables with end sprinkler performance. (Skogerboe-Colorado State)
W78-09665

CENTER PIVOTS: FINANCING OR LEASING,
A. J. LoBello.
Irrigation Journal, Vol 27, No 4, p 16-17, July-August, 1977. 1 fig, 1 tab.

Descriptors: Irrigation, *Irrigation systems, *Sprinkler irrigation, Economics, Financing, Leases, *Center pivots.

Center pivot systems are the fastest-growing sector of the irrigation equipment market. Of the two million acres coming under irrigation each year, it is estimated that 60 per cent now are center pivot, with the market growing about 15 per cent each year. At that rate, center pivot can be expected to constitute up to half of the systems in the United States in future years, and a total of some 50 million acres will come under this type of irrigation. Center pivot system currently run from $30,000 to $60,000 per unit. So, next to the right irrigation system for his needs, the ability to offer a customer the best financing package is one of the most improtant marketing tools a dealer has. Four financing plans are discussed. (Skogerboe-Colorado State)
W78-09667

ENERGY AND IRRIGATION SYSTEM PLANNING,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research.
A. Humpherys.
Irrigation Age, Vol 11, No 7, p 74-75, April, 1977. 2 tab.

Descriptors: *Irrigation systems, Irrigation engineering, Irrigation practices, Irrigation design, Economics, *Planning, *Energy, *Pumping.

Most irrigators are concerned with the spiraling costs and threatened shortages of energy for irrigation pumping. Energy costs are expected to continue increasing and, in some areas, limited energy supplies may restrict irrigation development. Irrigation systems are normally based on a least cost design. With low energy costs, for example, it has been more economical to use smaller pipes than would be used for minimum-energy designs. Future systems may require a minimum-energy design to minimize energy inputs. As energy costs increase, this also may be the least cost design. (Skogerboe-Colorado State)
W78-09669

GROWTH OF SPRINKLERS SIX TIMES FASTER THAN FURROW IRRIGATION.
Irrigation Age, Vol. 11, No. 5, p 28, 48, February, 1977. 1 fig, 1 tab.

Descriptors: *Sprinkler irrigation, *Furrow irrigation, Irrigation methods, Irrigation practices, Irrigation systems.

Sprinkler irrigation accounts for the major portion of the growth in irrigated areas in the United States. Between 1974 and 1975 the rate of growth of sprinkler irrigation was 6.2 times the rate of growth of gravity irrigation. The rapid increase in center pivot irrigation accounts for a major proportion of this growth in sprinkler irrigation. (Skogerboe-Colorado State)
W78-09670

SOLAR IRRIGATION SYSTEM BEGINS OPERATING IN NEBRASKA.
Irrigation Journal, Vol. 27, No. 5, p 37, September-October, 1977. 1 fig.

Descriptors: Irrigation, Irrigation practices, *Irrigation systems, Solar radiation, *Nebraska, *Solar irrigation systems.

One of the first crop irrigation systems to be powered by solar energy, began operating the end of July in Mead, Nebraska. The solar unit, designed by the Massachusetts Institute of Technology's Lincoln Laboratory, will use approximately 120,000 solar cells to convert the sun's rays into electricity. The unit drives a ten horsepower pump to irrigate 80 acres of corn and soybeans in the summer. In addition to irrigation, the solar powered system will be used during the fall and winter to dry crops that will be harvested from the field. (Skogerboe-Colorado State)
W78-09671

WATER'S KEY TO PROFITABLE ALFALFA SEED PRODUCTION.
Irrigation Age, Vol. 12, No. 2, p 38, 40, October, 1977. 3 fig.

Descriptors: *Alfalfa, *Crop production, Irrigation, Irrigation efficiency, Irrigation practices, *Washington, Seeds.

Water for irrigation, or the lack of it at critical times in the growing season, has turned the western end of Wala Walla County, Washington into one of the nation's prime locations for alfalfa seed production. Irrigation water for the area comes from the Blue Mountains. Unfortunately, water flow from the mountains stops the first of June and doesn't resume until September. This limits the growing of row crops which require summer-long irrigation. But for alfalfa seed, the availability of water is suitable. (Skogerboe-Colorado State)
W78-09672

THE FINE ART OF USING ENOUGH, BUT NOT TOO MUCH BORON,
Hawaii Univ., Honolulu. Dept. of Plant Physiology.
J. E. Bowen.
Crops and Soils Magazine, Vol. 29, No. 9, p 12-14, August-September, 1977. 2 fig, 1 tab.

Descriptors: *Boron, Nutrients, *Fertilizers, Fertilization, Crop production, *Crop response.

During the past 50 years several seemingly different diseases have appeared in different crops. These diseases were puzzlers to both farmers and agricultural researchers. It has now been determined that all of these diseases are actually caused by the same problem; a lack of boron. (Skogerboe-Colorado State)
W78-09673

LATERAL FLUSHING VALVES: A GUIDE TO PLANNING, INSTALLATION, OPERATION AND MAINTENANCE,
AMIAD Filtration and Irrigation Systems, Khorazim (Israel).
F. Beth.
Drip/Trickle Irrigation, Vol. 2, No. 1, p 27-29, January/February 1977.

Descriptors: Irrigation, Irrigation systems, *Irrigation practices, Suspended solids, Sprinkler irrigation, Orifices, Velocity, *Valves(Flushing), *Planning, Operations and maintenance.

There is now a well recognized need for the regular cleaning of irrigation lines where equipment with relatively small orifices is used; as with sprinklers, spray and mist nozzles, drippers, and simple orifices. The need becomes even more critical when the dirt load in the available water is high. The ability of a system to flush the irrigation network is provided in the lateral flushing valve, which has been developed during the last few years. It provides an automatic flushing action for cleaning all the irrigation lines at least once during each irrigation cycle. (Skogerboe-Colorado State)
W78-09674

CONSERVATION TILLAGE IN THE WESTERN CORN BELT,
Iowa State Univ., Ames. Dept. of Agronomy.
M. Amemiya.
Journal of Soil and Water Conservation, Vol. 32, No. 1, p 29-36, January-February 1977. 8 tab, 59 ref.

Descriptors: *Crop production, Agriculture, Soil erosion, Soil management, Soil conservation, Water quality, Erosion, *Cultivation, Corn(Field), *Great Plains.

Fertile soils and favorable climate make the western Corn Belt-Iowa, Minnesota, Missouri, and the humid areas of eastern Nebraska and eastern South Dakota - one of the world's outstanding grain-producing regions. For the western Corn Belt to continue to use its productive soils and favorable climate to help meet domestic and world agricultural needs will depend on how prudently the land resource is used. Soil erosion is the dominant limitation to agriculture on at least 30 percent of the region's cropland, and this cropland's potential contribution to watershed sediment yeild is very high. (Skogerboe-Colorado State)
W78-09675

CONSERVATION TILLAGE IN THE PACIFIC NORTHWEST,
Agricultural Research Service, Pullman, WA.
R. I. Papendick, and D. E. Miller.
Journal of Soil and Water Conservation, Vol. 32, No. 1, p 49-56, January-February, 1977. 4 fig, 1 tab, 49 ref.

Descriptors: *Cultivation, Crop production, Soil erosion, Erosion, Water conservation, Runoff, Soil surface, Soil properties, Soil management, Land resources, Agriculture, *Pacific Northwest US.

Despite years of research and development, tillage and cropping practices to conserve soil and water in the Pacific Northwest have not completely achieved the goals of efficient water use and soil protection. Precipitation and irrigation water still run off, and soil losses remain high. In the Palouse Region, for example, where the moldboard plow is widely used, erosion is as great as anywhere in the United States. There is a trend in many areas to reduced tillage and surface residue systems. (Skogerboe-Colorado State)
W78-09676

FUTURE USE OF AGRICULTURAL LAND FOR NONAGRICULTURAL PURPOSES,
Arkansas Univ., Fayetteville. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 4A.
W78-09677

IRRIGATION IN WYOMING,
Wyoming Univ., Laramaie. Dept. of Engineering.
D. J. Brosz.
In: Proceedings of the 1977 Annual Technical Conference, Irrigation for All Reasons, p 173-175, February 13-15, 1977.

Descriptors: *Irrigation, *Wyoming, Irrigation practices, Resources, Resource development, Water, Water conservation.

Wyoming has the opportunity to finance, through minerals, its own water projects; any size, without having to obtain money from the federal government. Now, state funds made available for loans can be authorized for: (1) Reclamation of new lands (irrigation); (2) Development of new water supplies for existing irrigated land that is short of water supplies; (3) Construction of reservoirs, diversion works, canals, pipelines, pumping stations, etc.; and (4) Development of groundwater. (Skogerboe-Colorado State)
W78-09678

PRACTICAL GROUND WATER MANAGEMENT,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
D. D. Axthelm.
In: Proceedings of the 1977 Annual Technical Conference, Irrigation for All Reasons, p 168-172, February 13-15, 1977.

Descriptors: *Groundwater, *Irrigation, Groundwater resources, Groundwater recharge, Groundwater mining, Groundwater basins, *Nebraska, Natural resources, Resources.

The emphasis on ground water development for irrigation lasted about a century. Concern has now shifted from development to management of the ground water resources. This emphasis will continue indefinitely. There is a current need to develop practical management methods and techniques. (Skogerboe-Colorado State)
W78-09679

SCHEDULING AND MONITORING IRRIGATION WITH INFRA-RED PHOTOGRAPHY,
Crop Protection, Inc., Umatilla, OR.
M. Pitney.
In: Proceedings of the 1977 Annual Technical Conference, Irrigation for All Reasons, p 176-177, February 13-15, 1977.

Descriptors: *Scheduling, *Irrigation, Irrigation practices, Soil moisture, Soil water, *Infrared radiation, Crop production, Crop response, *Aerial infrared photography, Remote sensing, *Monitoring.

Aerial infra-red photography is being used in agriculture to identify plants which are under stress from disease, moisture and nutrients. By interpretation of the infra-red reflectance, as recorded on film, it is possible to distinguish between healthy and unhealthy foliage. The value of photography is in the early detection of the stressed plants. The photography also makes the application of corrective measures quick and efficient. (Skogerboe-Colorado State)
W78-09680

IRRIGATION TECHNOLOGY AND AGRICULTURE PRODUCTION,
Western Empire Corp., Irrigon, OR.
D. Logan.
In: Proceedings of the 1977 Annual Technical Conference, Irrigation For All Reasons, p 178-180, February 13-15, 1977.

Descriptors: Irrigation, *Irrigation practices, Irrigation effects, Agriculture, *Crop production, *Oregon, *Technology(Irrigation).

An irrigation farmer presents his views of irrigated agricultural development and irrigation technology. (Skogerboe-Colorado State)
W78-09681

PLANNING SYSTEMS TO MAXIMIZE QUALITY AND PROFIT,
E. L. Bean.
In: Proceedings of the 1977 Annual Technical Conference, Irrigation for all Reasons, p 67-69, February 13-15, 1977.

Descriptors: Irrigation, Irrigation practices, Irrigation design, *Turf irrigation, Turf grasses, Water conservation, Soils, Sprinkler irrigation, *Irrigation systems.

Various design factors as related to irrigation systems are presented and discussed with particular emphasis on turf irrigation systems. (Skogerboe-Colorado State)
W78-09682

INFLUENCE OF IRRIGATION AND ENVIRONMENTAL FACTORS ON GRAPEFRUIT ACIDITY,
Volcani Agricultural Research Organization, Bet Dagan (Israel).
Y. Levy, A. Bar-Akiva, and Y. Vaadia.
Journal of the American Society of Horticultural Science, Vol. 103, No. 1, p 73-76, January, 1978, 1976 Series, No. 272-E. 4 fig, 21 ref.

Descriptors: *Moisture stress, Water requirements, Plant growth, Water supply, *Irrigation effects, Water demand, *Environmental effects, *Grapefruit, *On-site tests, Sampling, Israel, Negev Desert.

Previous studies of desert grown grapefruit (Citrus paradise Macf.) indicated grapefruit's acidity level increased in certain years during the winter months, especially in January, and caused the fruit to be less palatable. This irrigation experiment conducted in the northern Negev Desert, tested the environmental effects of different irrigation intervals on a grapefruit orchard. Fruit sampling indicated summer water stress in grapefruit caused high titratable acidity levels during the winter. The environmental effects of water reduction in the summer months could last up to six months. Brief, sudden rises of fruit acidity during the winter months correlated with correspondingly high daytime temperatures. Short-term warming did not effect the grapefruit's root environment. (Jewkes-Arizona)
W78-09713

HISTORY AND CHALLENGES IN SOIL AND WATER CONSERVATION AND MANAGEMENT,
Association of North Central State Agricultural Experiment Station, Ames, IA.
For primary bibliographic entry see Field 2G.
W78-09714

THE EFFECT OF CLIMATE ON IRRIGATED COTTON YIELDS UNDER SEMI-ARID CONDITIONS: TEMPERATURE-YIELD RELATIONSHIPS,
Isreal Meteorological Service, Bet-Dagan. Div. of Agricultural Meteorology.
J. Lomas, M. Mandel, and Z. Zemel.
Agricultural Meteorology, Vol. 18, No. 6, p 435-453, 1977. 7 tab, 6 fig, 26 ref.

Descriptors: *Semiarid climate, *Crop response, *Cotton, *Air temperature, *Yield equations, Irrigated crops, Crop production, Plant growth, Growth stages, Seeds, Germination, Mature growth stage, Coastal Plains, Harvesting, Irrigation practices, Fertilization, Soil environment, Variability, Flowering, Boll development, Israel, Agricultural practices, Sowing, Growing season.

The relationship between air temperature and cotton yields is reviewed for seed germination and emergence, early growth, flowering, and boll development and maturation. A data base was analyzed for cotton fiber yields in the Central

Coastal Plain of Israel, covering an 11-year period (1961-1971). Various agricultural practices such as sowing and harvesting dates, timing and amounts of irrigation and fertilization, and soil characteristics were noted. Multivariate temperature-yield analysis was performed, showing a wave-like response. Weekly maximum temperatures accounted for 28 percent, and weekly minimum temperatures for 14 percent of the variability of commercial cotton yields. Optimal temperatures are given for the four stages of plant growth through the entire growing season. (Popkin-Arizona)
W78-09717

A SIMULATION MODEL APPROACH FOR RELATING EFFECTIVE CLIMATE TO WINTER WHEAT YIELDS ON THE GREAT PLAINS,
Barnard Coll., New York.
For primary bibliographic entry see Field 2G.
W78-09723

FEDERAL LAW, IRRIGATION AND WATER POLLUTION,
For primary bibliographic entry see Field 5G.
W78-09724

GROUNDWATER WITHDRAWN FOR MUNICIPAL, INDUSTRIAL, AND IRRIGATION USE IN THE UPPER PEACE AND ALAFIA RIVER BASINS, WEST-CENTRAL FLORIDA, 1970-74,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 4B.
W78-09755

RATIONALISATION OF IRRIGATION RATES IN A DEVELOPING COUNTRY,
Central Water Commission, New Delhi (India).
C. V. Gole, V. N. Amble, and M. M. L. Chopra.
Internationa Commission on Irrigation and Drainage Bulletin, Vol. 26, No. 1, p 31-40, 49, January, 1977. 1 tab, 6 ref.

Descriptors: *Irrigation water, Irrigation, Irrigation practices, *Pricing, *Water demands, Economics, *Water rates.

The problem of fixation of irrigation rate assumes particular importance in a developing country like India where the State has to assume responsibility for the large scale supply of irrigation. The irrigation rate has then to be determined balancing two opposing considerations. On the one hand, it is necessary to recover the costs and even a share of the benefit received by the irrigator in the interest of resource mobilization for further development as the benefit of irrigation accures only to a small section of the population. On the other hand, the producer has to be provided the incentive for increasing production through greater utilization of irrigation. Practices with regard to irrigation rates in various States of India and some other countries are reviewed and principles for arriving at a rational structure of irrigation rates are discussed. (Skogerboe-Colorado State)
W78-09761

DRIP IRRIGATION,
K. Shoji.
Scientific American, p 62-68, November, 1977. 5 fig, 1 tab.

Descriptors: Irrigation, Irrigation systems, *Irrigation efficiency, Crop production, Soil water, Soil water movement, *Water conservation, *Saline water, Salinity, *Drip irrigation.

Plastic pipes laid on the surface of the ground deliver water to plants drop by drop. The system reduces stress on the plant, conserves water and works well with saline water. (Skogerboe-Colorado State)
W78-09767

SOIL AND WATER CONSERVATION PRACTICES FOR POLLUTION CONTROL,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5G.
W78-09768

COMPARISON OF SURFACE-DRAINED AND SUBSURFACE-DRAINED CLAYPAN SOILS,
Illinois Univ. at Urbana-Champaign Dept. of Agricultural Engineering.
P. N. Walker.
Paper No. 77-2589 presented at the 1977 Winter Meeting of the American Society of Agricultural Engineers, December 13-16, 1977. Chicago, Illinois, 6 p, 5 fig, 1 tab, 3 ref.

Descriptors: *Corn(Field), *Crop production, Drainage, Irrigation, *Irrigation effects, *Drainage effects, Furrow irrigation, Sprinkler irrigation.

Corn grown in claypan soil received ten different combinations of drainage and irrigation treatments. One year's yield data indicate no major differences between the drainage treatments or between sprinkler and furrow irrigation. Irrigated plot yields averaged 9.3 tonnes/ha. Nonirrigated plot yields averaged 4.3 tonnes/ha. (Skogerboe-Colorado State)
W78-09769

CAPILLARY POTENTIAL DISTRIBUTIONS IN ROOT ZONES USING SUBSURFACE IRRIGATION,
Department of Agriculture, Watkinsville, GA.
For primary bibliographic entry see Field 2G.
W78-09770

TRICKLE AND SPRINKLER IRRIGATION OF GRAIN SORGHUM,
Texas A and M Univ., College Station. Dept. of Agricultural Engineering.
C. J. Ravelo, E. A. Hiler, and T. A. Howell.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 20SW, p 96-99, February 20, 1977. 5 fig, 3 tab, 18 ref.

Descriptors: *Sprinkler irrigation, *Crop response, *Grain sorghum, Lysimeters, Crop production, Irrigation systems, Water measurement, Water control, Water balance, *Trickle irrigation.

Crop response and water use efficiency (ratio of grain yield to total crop water use) of grain sorghum in an environmentally controlled lysimeter installation were investigated using trickle and sprinkler irrigation. Also, effects of different trickle irrigation frequencies on the crop growth and grain yield were studied. Results indicate no significant differences in yield or water use efficiency when using trickle and sprinkler irrigation with three irrigations per week. Also, trickle irrigation frequencies of 1, 2, and 3 irrigations per week appeared to have no significant effect on yield or water use efficiency of grain sorghum on a layered sandy loam soil. (Skogerboe-Colorado State)
W78-09772

IMPROVED SEMI-AUTOMATIC GATES FOR CUT-BACK SURFACE IRRIGATION SYSTEMS,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 4A.
W78-09773

RECLAIMING PARTIALLY CLOGGED TICKLE EMITTERS,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 5G.
W78-09774

SUGAR BEET RESPONSE TO WATER STRESS IN SANDY SOILS,
North Dakota State Univ., Fargo. Dept. of Agricultural Engineering.
E. C. Stegman, and A. Bauer.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 20SW, p 469-473, June 20 1977. 12 fig, 1 tab, 13 ref, 1 equ.

Descriptors: *Sugar beets, Plant growth, *Crop response, Crop production, Soil water, Irrigation effects, *Soil moisture, Leaves, *Water stress, *Sands.

Leaf xylem pressure data suggest brief reductions to about -14 to -15 bars may be tolerable provided average pressure over 10-20 day intervals is above -12bars. Seasonal average pressures of -15 and -21 bars reduce yields to 0.6 and 0.1 that of a nonstress treatment, respectively. Water management criteria based upon allowable levels of leaf xylem pressure are suggested. (Skogerboe-Colorado State).
W78-09776

MANAGEMENT OF BED-FURROW IRRIGATED SOIL WITH LIMITED AND NO-TILLAGE SYSTEMS,
Southwestern Great Plains Research Center, Bushland, TX.
J. T. Musick, A. F. Wiese, and R. R. Allen.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 20SW, p 666-672, August 20, 1977. 1 fig, 4 tab, 8 ref.

Descriptors: *Irrigation systems, *Furrow systems, Crop production, Management, *Soil water, Irrigation water, Grain sorghum, *Furrow irrigation, Cultivation.

Limited and no-tillage management in the Southern Plains can be beneficially used in irrigated cropping systems. About 75 percent of the irrigation in this region is by the graded-furrow method. Learning how to manage beds and furrows between crops is essential for development of practical management systems. Results are reported of 7 years of field research in developing and evaluating limited and no-tillage management systems for irrigated crop production. (Skogerboe-Colorado State).
W78-09777

IMPROVING WATER USE IN SPRINKLING FOR BLOOM DELAY,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.
B. J. Barfield, G. M. White, T. C. Bridges, and C. Chaplin.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 20SW, p 688-691, 696, August 20, 1977. 5 fig, 8 ref.

Descriptors: *Sprinkler irrigation, Cooling, *Peaches, *Fruit crops, Evaporation, Mist, Transpiration, Frost protection, Water utilization.

Bud development was delayed on Redhaven peach trees in 1975 by using evaporative cooling from sprinkler irrigation when bud temperatures exceeded 4.4C. 104 cm of water were applied. Analysis was made of the potential reduction in water use and cooling that would have been obtained if sprinkling had been initiated at bud temperatures ranging from 4.4 to 9C whenever cooling potential existed. Cooling potential was measured by the difference between dry bud temperature and wet bulb temperature. The optimum set points for initiating sprinkling were dry bud temperature of 6.7C and a cooling potential of 2.0C. (Skogerboe-Colorado State)
W78-09778

IRRIGATION APPLICATION DEPTHS FOR OPTIMUM CROP PRODUCTION,
South Dakota State Univ., Brookings, Dept. of Agricultural Engineering.
D. W. DeBoer, D. D. Brosz, and J. L. Wiersma.
Transactions of the American Society of Agricultural Engineering.

Descriptors: *Sprinkler irrigation, *Soil moisture, Corn(Field), *Crop production, Grains(Crops), *Application methods, *Water utilization, Sirface irrigation, Irrigation water, Evapotranspiration, *South Dakota, Tensiometers.

Consideration of all soil properties important to water management decisions is beyond the scope of this report. Emphasis is placed on some techniques for using water related properties of soils in management decisions and impedance characteristics that reduce effective plant root extension. (Skogerboe-Colorado State).
W78-09779

ESTIMATING RUNOFF FROM FURROW IRRIGATION,
Kansas State Univ., Garden City. Garden City Experiment Station.
For primary bibliographic entry see Field 4A.
W78-09780

GYPSUM BLOCKS, TENSIOMETERS RELIABLE SOIL MOISTURE MONITORS.
Irrigation Age, Vol. 11, No. 7, p 31, 40, 48, April, 1977. 1 fig, 4 tab.

Descriptors: *Tensiometers, *Soil moisture, Soil water, Crop production, Irrigation, *Irrigation efficiency.

Two dependable, easy to use methods for irrigation scheduling are electrical resistance blocks and tensiometers. Both systems will help conserve water and increase yields. A brief run-down on each with suggestions on how to use them is presented. (Skogerboe-Colorado State)
W78-09781

ESTIMATING LEAF WATER POTENTIAL IN SAFFLOWER,
Pahlavi Univ., Shiraz (Iran). Dept. of Irrigation.
A. R. Sepaskhah.
Agronomy Journal, Vol. 69, No. 5, p 894-896, September-October 1977. 1 fig, 14 ref.

Descriptors: Crop production, Greenhouses, Laboratory tests, Laboratory equipment, Leaves, *Safflower, *Estimating, Measurement.

The pressure chamber technique is used for rapid measurements of plant water potential. Comparison of this method with thermocouple psychrometer technique is required at various stages of growth for different crops. Xylem water potential estimated by pressure chamber and leaf water potential measured by thermocouple psychrometer were correlated for safflower leaves at vegetative and flowering stages of growth in greenhouse conditions. The results of the two methods were linearly related for both growth stages but the equations were different at the 1% level. The values of ordinate intercept were nearly equivalent to the xylem sap osmotic potentials at the both stages of growth. (Skogerboe-Colorado State)
W78-09783

THE DEPENDENCE OF IRRIGATION REQUIREMENTS ON WATER-TABLE DEPTH IN DRAINED LANDS,
Vsesoyuznyi Nauchno-Issledovatelskii Inst. Gidrotekhniki i Melioratsii, Moscow (USSR).
Y. N. Nikolski.
Agricultural Water Management, Vol. 1, No. 2, p 191-196, September, 1977. 3 fig, 9 ref.

The amount of irrigation water required to maintain an optimal average water content in the root zone for maximum crop yield is dependent on the water-table depth as well as on evapotranspiration. An approximate expression is derived in terms of soil constants for the vertical soil water flux, which may be directed upwards or downwards, above the water table. This has been used in a water-balance equation in order to estimate the irrigation requirement. Satisfactory agreement is found between results calculated using this theoretical relationship and published experimental work. (Skogerboe-Colorado State)
W78-09785

DRIP IRRIGATION STRIKES BACK AT WATER SHORTAGES,
California Univ., Riverside.
S. Davis.
Irrigation Age, Vol. 11, No. 9, p 31, 35, July-August, 1977.

Descriptors: Irrigation, Irrigation systems, *Irrigation practices, *Water conservation, *Drip irrigation.

To solve the drought problem in 1977, or during any dry year, one must learn to store more water and make more use of our available water. One efficient way to accomplish the latter is with drip irrigation. (Skogerboe-Colorado State)
W78-09788

SUGAR BEETS TOLERATE MORE LIMITED IRRIGATION,
Texas A and M Univ., Lubbock. Research Center.
L. New.
Irrigation Age, Vol 12, No 1, p 51-52, September, 1977. 2 fig, 1 tab.

Descriptors: *Sugar beets, Irrigation, *Irrigation effects, Irrigation practices, *Water conservation, Evapotranspiration, *Water demand.

Sugar beets, once considered to have high and critical demands for water, have yielded well under more limiting irrigation in field tests near Hereford, Texas. In 5-year irrigation demonstrations, sugar beets that were irrigated on 3-week intervals averaged 27.3 tons per acre, while beets that were irrigated on 2-week intervals averaged 26.7 tons. Irrigation applications averaged about 8 inches less when irrigating on the 3-week frequency. In a third comparison, sugar beets irrigated on 4-week intervals averaged 24.3 tons per acre. (Skogerboe-Colorado State)
W78-09789

NEUTRON PROBE PROMISING SCHEDULING TOOL,
Bureau of Reclamation, Boulder City, NV. Lower Colorado Regional Office.
A. S. Dronsfield.
Irrigation Age, Vol. 11, No. 8, p 38, May-June, 1977. 1 fig.

Descriptors: *Soil water, *Soil moisture, Crop production, Irrigatioa, Irrigation efficiency, Irrigation practices, *Neutron probe(Soils).

The Neutron Probe is now a field tool and can be used to determine when to irrigate and how much water to apply. It has been recognized as an excellent research instrument for determining soil moisture content. (Skogerboe-Colorado State)
W78-09792

IRRIGATED SOYBEANS: BIG YIELDS FROM A LITTLE TIMELY WATER,
J. Schleicher.
Irrigation Age, Vol. 11, No. 7, p 16, 18, 20, April, 1977. 2 fig.

Descriptors: *Soybeans, *Crop production, Irrigation, *Irrigation efficiency, Irrigation water, Crop response.

Soybean irrigation has a strong hold in the Midwest. In Nebraska last year, an estimated 200,000 acres of soybeans were produced under irrigation. Some 120,000 acres of soybeans were grown with supplemental water in Texas. Another 90,000 acres were irrigated in Missouri in 1976, 35,000 acres in Kansas, and an estimated 17,000 acres in Oklahoma. (Skogerboe-Colorado State)
W78-09793

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

HYDROLOGIC DATA OF THE COASTAL DRAINAGE BASINS OF SOUTHEASTERN MASSACHUSETTS, PLYMOUTH TO WEWEANTIC RIVER, WAREHAM,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09304

HYDROLOGIC DATA OF THE CHARLES RIVER BASIN, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09305

FLOOD PROFILES OF THE ALAFIA RIVER, WEST-CENTRAL FLORIDA, COMPUTED BY STEP-BACKWATER METHOD,
Geological Survey, Tallahassee, FL. Water Resources Div.
A. F. Robertson.
Water-Resources Investigations 77-74 (open-file report), March 1978. 21 p, 8 fig, 2 tab, 9 ref.

Descriptors: *Flood frequency, *Flood peak, *Flood discharge, *Flood profiles, Flood recurrence interval, Flood data, Flood routing, Streamflow, Gaging stations, Florida, *Alafia River, West-central Florida, *Step-backwater method.

The Alafia River is a coastal stream that discharges into Hillsborough Bay. The river and its two principal tributaries, North Prong Alafia River and South Prong Alafia River, drain an area of 420 sq mi of predominantly rural land. However, near the coast, urban residential developments are increasing. The flood plain of the river is subject to flooding, particularly during large regional storms. Peak-discharge frequencies have been determined for data available at two gaging stations in the basin. The flood profiles for peak discharges of recurrence intervals of 2.33, 5, 10, 25, 50, 100, and 200 years have been determined using the step-backwater method. These profiles can be used in conjunction with topographic maps to delineate the area of flooding. Flood profiles were not determined for the tidally affected area near the mouth of the river. Flood marks were located that can be associated with the 1960 flood which occurred when Hurricane Donna passed over the area. (Woodard-USGS)
W78-09308

WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1977--VOLUME 2. LONG ISLAND.
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09311

WATER RESOURCES DATA FOR ILLINOIS, WATER YEAR 1977.
Geological Survey, Champaign, IL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09312

WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1977--VOLUME 1. NEW YORK EXCLUDING LONG ISLAND.
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09313

CHARACTERISTICS OF THE HYDROLOGIC REGIME OF LARGE SIBERIAN RESERVOIRS,
Yu. I. Podlipskiy, and V. M. Shirokov.
Soviet Hydrology: Selected Papers, Vol. 15, No. 3, p 171-178, 1976. 6 fig, 2 tab, 6 ref. Translated from Trudy IV Vsesoyuznogo Gidrologicheskogo S'yezda, Vol. 5, p 36-52, 1975.

Descriptors: *Reservoirs, Hydrologic properties, *Classification, Runoff, Storage, Suspended solids, Sedimentation, Reservoir silting, Reservoir storage, Water temperature, Cold regions, Hydrology, *Siberia(USSR), *USSR.

At the present time, 10 large reservoirs are in operation or under construction in Siberia. In some cases the head at the water power system reaches 100 m or more. Siberia has such gigantic reservoirs as the Bratsk Reservoir with a volume of about 170 cu km, the Krasnoyarsk Reservoir, etc. Large new hydraulic engineering installations are to be built in the future. The magnitude of runoff regulation will exceed 400 cu m of the useful storage of reservoirs by the year 2000 and will amount to about 25% of all Siberian water resources. By that time, the exploitation of the economic potential of water power resources will reach 35-40%. This rate of development of Siberian rivers makes it possible even now to raise the question of determining the main characteristics of the hydrologic regime of large future reservoirs. To evaluate the diversity of reservoirs created in Siberia, their topological classification was developed. From pertinent investigations it was found that large reservoirs develop under the effect of both natural conditions and river regulation. Among the most important natural factors determining the individual character of reservoirs are the land features that are flooded and surround the reservoirs and the landscape of those geographic zones where the reservoirs are created. The water management factors that affect reservoirs include the nature of their utilization and their operating conditions during regulation of water reserves. (Sims-ISWS)
W78-09336

SOLUTIONS OF BOUSSINESQ'S EQUATION FOR SEEPAGE FLOW,
Argonne National Lab., IL. Div. of Environmental Impact Studies.
For primary bibliographic entry see Field 2F.
W78-09343

UNBIASED PLOTTING POSITIONS-A REVIEW,
Ireland Office of Public Works, Dublin.
For primary bibliographic entry see Field 7C.
W78-09348

THE IMPACT OF SEASONAL FLOW CHARACTERISTICS AND DEMAND PATTERNS ON REQUIRED RESERVOIR STORAGE,
Hokkaido Univ., Sapporo (Japan). Dept. of Civil Engineering.
K. Hoshi, and S. J. Burges.
Journal of Hydrology, Vol. 37, No. 3/4, p 241-260, May 1978. 5 fig, 4 tab, 18 ref.

Descriptors: *Streamflow, *Routing, *Reservoirs, *Synthetic hydrology, *Model studies, Reservoir storage, Seasonal, Storage requirements, Stochastic processes, Mathematical models, Statistical models, Analytical techniques, Water demand, Markov processes, Annual, Correlation analysis, Statistical methods, Theoretical analysis.

Annual streamflow volumes, modeled by AR(1) and autoregressive moving average model (ARMA(1,1)) processes, were generated and disaggregated to seasonal flow volumes and routed through a reservoir algorithm to determine the within-year capacity of a single reservoir needed to satisfy a specified demand sequence. Six seasons, each of two months duration, were used to investigate the impact of seasonal demand-seasonal flow variability coupling. Annual synthetic flows were disaggregated by a modified version of the disaggregation scheme which has been developed by Valencia and Schaake. Annual demand levels of 0.3, 0.5, and 0.7 of the mean annual flow were used. Three seasonal patterns representing relatively uniform demand, demand in phase with streamflow, and demand out of phase with streamflow were used. Modeling the skewed distributions of seasonal flows was shown to be important at all demand levels investigated. (See also W73-11141) (Humphreys-ISWS)
W78-09350

INTEGRATING ECOLOGICAL AND SOCIAL CONSIDERATIONS INTO URBAN FLOOD CONTROL PROGRAMS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 6G.
W78-09460

HYDROLOGIC EFFECTS OF THE TONKAWA CREEK FLOOD ABATEMENT PROGRAM,
Agricultural Research Service, Chickasha, OK. Southern Great Plains Water Research Center.
R. R. Schoof, J. W. Naney, and W. M. Boxley.
Water Resource Bulletin, American Water Resources Association Vol. 14, No. 3, June 1978, p 629-639, 6 fig, 1 table, 4 ref.

Descriptors: Hydrology, *Flood control, *Floodwater-retarding impoundments, Streamflow, Channelization, Water yield, *Oklahoma, Impoundments, Reservoir operation, *Washita River basin(Okla), *Tonkawa Creek(Okla).

Floodwater-retarding impoundments, controlling 68 percent of the drainage area of Tonkawa Creek, a Washita River tributary in southwestern Oklahoma, have reduced the total flow volume about 36 percent over a 5-year period. Analyses showed the reduction occurred primarily in the less-than-2.5-cfs flow range, indicating the base flow regime has been altered. However, channelizing the downstream, mild-sloped, 3.6 miles of Tonkawa Creek that flows across a Washita River terrace increased the flow volume fourfold at the outlet. A double-mass-curve analysis of water yield from a 1,127-square-mile Washita basin segment versus an untreated tributary showed the yield has not changed after 25 percent of the tributary area had been treated. Therefore, the flow reduction caused by structures is being offset by increased yields from channelization. (ARS)
W78-09461

PLAYER'S GUIDE. THE RIVER BASIN MODEL.
Washington Environmental Research Center, DC. Environmental Studies Div.
For primary bibliographic entry see Field 6A.
W78-09522

RECREATION AND INSTREAM FLOW. VOLUME 1, FLOW REQUIREMENTS, ANALYSIS OF BENEFITS, LEGAL AND INSTITUTIONAL CONSTRAINTS.
Cortell (Jason M.) and Associates, Inc., Waltham, MA.
For primary bibliographic entry see Field 6E.
W78-09543

CODIFIED AND UNCODIFIED STATE LAWS AND AGENCY RULES AND REGULATIONS BEARING ON WATER AND RELATED LAND RESOURCES IN MINNESOTA, VOLUME 1.
Minnesota Univ., St. Paul. Water Resources Research Center.
For primary bibliographic entry see Field 6E.
W78-09571

SHORT-TERM FORECASTING OF WATER RUN-OFF FROM SNOW AND ICE,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2C.
W78-09645

TRICKLE IRRIGATION: PREVENTION OF CLOGGING,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 3F.
W78-09662

FUTURE USE OF AGRICULTURAL LAND FOR NONAGRICULTURAL PURPOSES,
Arkansas Univ., Fayetteville. Dept. of Agricultural Economics and Rural Sociology.
B. W. Spaulding, and E. O. Heady.
Journal of Soil and Water Conservation, Vol. 32, No. 2, p 88-93, March-April 1977. 2 fig, 6 tab, 16 ref.

Descriptors: Agriculture, *Urbanization, *Land use, *Land development, Land resources, Land management, Land classification, Agricultural land.

A procedure to estimate the acreage of agricultural land needed for nonagricultural purposes in the continental United States to the year 2000 was developed. The acreage to be converted by the turn of the century represents a 2.2 percent reduction in the nation's existing agricultural land base. Overall, the nation's productive capacity in agriculture will not be impaired significantly by this loss of land to nonagricultural purposes. However, the impacts will likely be significant at state and local levels. (Skogerboe-Colorado State)
W78-09677

STATE'S RIGHTS REVISITED: THE NINTH CIRCUIT LEADS THE BUREAU OF RECLAMATION TO WATER.
For primary bibliographic entry see Field 6E.
W78-09700

HYDROLOGIC DATA FOR LITTLE ELM CREEK, TRINITY RIVER BASIN, TEXAS, 1976,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09736

TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W78-09737

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1977--VOLUME 2. ST. LAWRENCE RIVER BASIN.
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09738

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1977--VOLUME 1. OHIO RIVER BASIN.
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09739

WATER RESOURCES DATA FOR KANSAS, WATER YEAR 1977.
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09740

SELECTED HYDROLOGIC DATA, YAMPA RIVER BASIN AND PARTS OF THE WHITE RIVER BASIN, NORTHWESTERN COLORADO AND SOUTH-CENTRAL WYOMING,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09748

PUBLIC WATER SUPPLIES OF NORTH CAROLINA, A SUMMARY OF WATER SOURCES, USE, TREATMENT, AND CAPACITY OF WATER-SUPPLY SYSTEMS,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 5F.
W78-09753

IMPROVED SEMI-AUTOMATIC GATES FOR CUT-BACK SURFACE IRRIGATION SYSTEMS,
Colorado State Univ., Fort Collins. Dept. of Agricultural Engineering.
R. G. Evans.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 20SW, p 105-108, 112, February 20, 1977. 7 fig, 1 tab, 12 ref.

Descriptors: Surface irrigation, *Gates, *Irrigation systems, *Automation, *Furrow irrigation, Furrow systems, Irrigation design, Irrigation efficiency, Irrigation practices.

One of the most effective means of improving application efficiency and uniformity in furrow irrigation systems is the cut-back concept. The cut-back systems are very amendable to automation, however, one of the largest obstacles to its widespread use has been a lack of simple, inexpensive and reliable equipment to automate the systems. A much simplified version of a semi-automatic 'drop-open' type of gate has been developed and its construction, field operation and reliability are discussed. A simplified 'drop-closed' type of gate is also discussed. Both gate types are constructed of aluminum, use mechanical Corct timers and are interchangeable. (Skogerboe-Colorado State)
W78-09773

CALLAHAN RESERVOIR: II. INFLOW AND OUTFLOW SUSPENDED SEDIMENT PHOSPHORUS RELATIONSHIPS,
Agricultural Research Service, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5G.
W78-09775

ESTIMATING RUNOFF FROM FURROW IRRIGATION,
Kansas State Univ., Garden City. Garden City Experiment Station.
F. E. Ohmes, and H. L. Manges.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 20SW, p 1089-1092, December 20, 1977. 3 fig, 2 tab, 6 ref.

Descriptors: *Furrow irrigation, Inflow, *Runoff, Irrigation efficiency, Equations, Flow rates, *Agricultural runoff, *Estimating.

Inflow into and outflow from furrows during irrigation were measured. Both theory and field measurements have shown that runoff rate from a graded furrow can be expressed as a function of time for the rising portion of the runoff hydrograph and then becomes constant. Volume of runoff can be determined by integrating the runoff equations. (Skogerboe-Colorado State)
W78-09780

SOIL-ASPHALT MIXTURE FOR CANAL SEEPAGE CONTROL: LABORATORY STUDY,
Department of Agriculture, Lethbridge (Alberta). Research Station.
T. G. Sommerfeldt.
Canadian Agricultural Engineering, Vol. 19, No. 2, p 111-115, December, 1977. 5 fig, 3 tab, 10 ref.

Descriptors: Laboratory tests, *Seepage control, Seepage, Asphalt, Soils, Irrigation canals, Model studies, Salinity, Linings, Canals.

A material for lining irrigation canals composed of soil, anionic asphalt emulsion, Wyoming bentonite, an enzymatic wetting agent, and water was developed in the laboratory. Discs of the material were tested for seepage control, and resistance to erosion, weathering, freezing, and thawing. A ditch model was subjected to a continuous stream of water for 30 days. The material was satisfactory under laboratory conditions. It had some flexiblity and, when wet, was soft and spongy, similar to gum rubber. This flexibility would be advantageous for canals where shifting of the base or frost-heaving is a problem. But, because of its softness, damage from livestock and similar traffic may be a problem. (Skogerboe-Colorado State)
W78-09787

U.S. RESERVOIR INVENTORY,
National Reservoir Research Program, Fayetteville, AR.
R. M. Jenkins.
U.S. Dept. of the Interior, April 1, 1976. 35 p, 35 tab.

Descriptors: *Reservoirs, *Reservoir fisheries, *Reservoir sites, *Reservoir yield, Artificial lakes, Reclamation, Recreation Demand, United States, *Reservoir Inventory(US).

A nationwide compilation of reservoirs in the United States as of January 1, 1976 arranged by states and listed by name and average surface area has been prepared. A 1960 inventory of U.S. Waters totalled 6,450,000 acres. In the next decade, 314 reservoirs totalling 5,394,000 acres were added. In the next six years, to 1976, 173 reservoirs totalling 930,000 acres have been added. (EIS-Katz)
W78-09797

THE EFFECTS OF ALTERED STREAMFLOWS ON FISH AND WILDLIFE IN CALIFORNIA,
Jones and Stokes Associates, Inc.,
For primary bibliographic entry see Field 5C.
W78-09798

4B. Groundwater Management

HYDROLOGIC DATA OF THE COASTAL DRAINAGE BASINS OF SOUTHEASTERN MASSACHUSETTS, PLYMOUTH TO WEWEANTIC RIVER, WAREHAM,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09304

HYDROLOGIC DATA OF THE CHARLES RIVER BASIN, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09305

STRATIGRAPHIC AND HYDROGEOLOGIC FRAMEWORK OF PART OF THE COASTAL PLAIN OF TEXAS,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 2F.
W78-09310

WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1977--VOLUME 2. LONG ISLAND.
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09311

WATER RESOURCES DATA FOR ILLINOIS, WATER YEAR 1977.
Geological Survey, Champaign, IL. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09312

WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1977--VOLUME 1. NEW YORK EXCLUDING LONG ISLAND.
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09313

FLOW THROUGH UNCONFINED AQUIFERS CONTAINING INTERCEPTOR DRAINS,
Agricultural Research Council, Cambridge (England). Unit of Soil Physics.
E. G. Youngs, and M. A. Al-Najim.
Journal of Hydrology, Vol. 37, No. 3/4, p 339-348, May 1978. 5 fig, 11 ref.

Descriptors: *Aquifers, *Drainage, *Model studies, *Water table aquifers, Groundwater movement, Drains, Storm drains, Interceptor sewers, Seepage, Mathematical models, Flow, Analytical techniques, Theoretical analysis, Equations, Laboratory tests, Hele-Shaw analog.

The flow into interceptor drains, located in an aquifer bounded by water standing at different levels in two parallel vertical ditches which extend in depth to a horizontal floor on which the aquifer rests, and the discharge into the downstream ditch were shown to be related to the water levels in the ditches by a modified form of Dupuit's formula. For the case of an aquifer resting on an inclined impermeable floor, seepage analysis gives an approximate expression which is an extended form of that obtained without the inclusion of interceptor drains. Hele-Shaw analog results were used to give experimental confirmation of the theoretical relationships. (Humphreys-ISWS)
W78-09355

UNSTEADY FLOW TO A PUMPED WELL IN AN UNCONFINED FISSURED AQUIFER,
Sheffield Univ. (England). Dept. of Civil and Structural Engineering.
For primary bibliographic entry see Field 2F.
W78-09356

CONTROLLING IMPOUNDMENTS WHICH MAY POLLUTE GROUNDWATER,
Maryland Water Resources Commission, Annapolis. Permits Div.
For primary bibliographic entry see Field 5G.
W78-09419

TEHRAN GROUND WATER POLLUTION BY DETERGENTS,
Tehran Univ. (Iran). Dept. of Environmental Health.
For primary bibliographic entry see Field 5A.
W78-09421

A PRELIMINARY ASSESSMENT OF THE EFFECTS OF SUBSURFACE SEWAGE SLUDGE DISPOSAL ON GROUNDWATER QUALITY,
Environmental Protection Agency, Washington, DC. Office of Solid Waste Management Program.
For primary bibliographic entry see Field 5C.
W78-09572

TETRACHLOROETHYLENE IN CONTAMINATED GROUND AND DRINKING WATERS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
For primary bibliographic entry see Field 5B.
W78-09593

NITROGEN, CHLORIDE, AND WATER BALANCE WITH IRRIGATED RUSSET BURBANK POTATOES IN A SANDY SOIL,
Wisconsin Univ.-Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W78-09652

PRACTICAL GROUND WATER MANAGEMENT,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W78-09679

FEDERAL GROUNDWATER RIGHTS: A NOTE ON CAPPAERT V. UNITED STATES,
Stanford Univ., CA., School of Law.
C. J. Meyers.
Land and Water Law Review, Vol. 13, No. 2, p. 377-389 (1978).

Descriptors: *Groundwater management, *Federal reservations, *Federal-state water rights conflicts, *Water allocation(Policy), *Competing uses, Prior appropriation, Legal aspects, Water rights, Aquifers, Groundwater mining, Groundwater availability, Groundwater resources, Withdrawn lands, Distribution, Equitable apportionment, Planning, Water supply, Water utilization, Wells, Well spacing, Water pumping, Sage yield, Reservation doctrin.

The United States Supreme Court decision in Cappaert v. United States lays the foundation for extensive federal claims to groundwater. The author broadly states the rule as follows: the withdrawal of federal lands from entjry and their reservaton for other purposes (refuges, parks) reserves groundwater as may be needed to realize the purposes of the reservation, and the government may pump groundwater even if the pumping interferes with groundwater use by others. Moreover, the government may enjoin groundwater pumping by others if such pumpinginterferes with groundwater use by others. Moreover, the government may engjoin groundwater pumping by others if such pumping interfers with government use of groundwater for a reservaton purpose. With such precedent for sweeping governmental claims, competition between federal and private groundwater users is inevitable. The author proposes federal legislation; (1) instituting a sound groundwater regimen, (2) appointing basin managjers to contested qaulfers, and (3) treating all pumpers as equals under the same rules regarding well interference, division of safe yield, and right to mine. In the absence of legislation, federal courts must construct a fair and maximally efficient system of distribution groundwater. A similar fair distribution policy and 'Rule of Reason' are appropriate in adjudicating Indians' claims to groundwater. (Baumbach-Florida)
W78-09726

WATER CONFLICTS FROM THE VIEWPOINT OF A REGULATION,
Utah State Engineers' Office, Salt Lake City.
For primary bibliographic entry see Field 3E.
W78-09730

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1977--VOLUME 2. ST. LAWRENCE RIVER BASIN.
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09738

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1977--VOLUME 1. OHIO RIVER BASIN.
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09739

WATER RESOURCES DATA FOR KANSAS, WATER YEAR 1977.
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09740

CALIBRATION OF A MATHEMATICAL MODEL OF THE ANTELOPE VALLEY GROUND-WATER BASIN, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W78-09741

WATER FOR INDUSTRIAL DEVELOPMENT IN GEORGE, HANCOCK, PEARL RIVER, AND STONE COUNTIES, MISSISSIPPI,
Geological Survey, Nashville, TN. Water Resources Div.; and Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 6D.
W78-09744

SUMMARY OF WATER RESOURCES FOR THE CAMPO, CUYAPAIPE, LA POSTA, AND MANZANITA INDIAN RESERVATIONS AND VICINITY, SAN DIEGO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09746

SELECTED HYDROLOGIC DATA, YAMPA RIVER BASIN AND PARTS OF THE WHITE RIVER BASIN, NORTHWESTERN COLORADO AND SOUTH-CENTRAL WYOMING,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09748

PREDICTING SOLUTE TRANSPORT IN SUBSURFACE WATERS,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W78-09752

GEOCHEMICAL AND HYDROLOGIC DATA FOR WELLS AND SPRINGS IN THERMAL-SPRING AREA OF THE APPALACHIANS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09754

GROUNDWATER WITHDRAWN FOR MUNICIPAL, INDUSTRIAL, AND IRRIGATION USE IN THE UPPER PEACE AND ALAFIA RIVER BASINS, WEST-CENTRAL FLORIDA, 1970-74,
Geological Survey, Tallahassee, FL. Water Resources Div.
A. F. Robertson, L. R. Miller, and D. C. Parsons.
Open-file report 78-29, March 1978. 59 p, 4 fig, 11 tab, 3 ref.

Descriptors: *Groundwater, *Withdrawal, *Water utilization, *Water supply, *Florida, Municipal water, Industrial water, Irrigation wells, *Upper Peace and Alafia River basins, Floridan aquifer.

Data are presented for ground-water withdrawals for municipal, industrial and irrigation use in the upper Peace and Alafia River basins during 1970-71. Within the 1,160-square-mile study area, the principal source of ground water is the Floridan aquifer. Methods used to determine ground-water withdrawal include: metering water use; relating measured well discharge to power consumption of pumping time; and relating water use to phosphate production, citrus irrigation or processing. About 90 percent of municipal pumpage is metered, and annual pumpage increased from 11,165 million gallons in 1970 to 13,455 in 1974. Water use per ton of phosphate produced is estimated to be 3,320 gallons per ton prior to 1971 and 2,460 gallons per ton from 1971 through 1974. Estimated ground-eater use by the phosphate industry has declined from 93.3 billion gallons in 1970 to 78.7 in 1974. Citrus irrigation pumpage is obtained by extrapolating pumpage obtained from pilot areas of unmeasured areas and has declined from 33.4 billion gallons in 1970 to 31.3 in 1974. The citrus processing industry used about 4.9 billion gallons in 1970 and about 5.9 in 1974. (Woodard-USGS)
W78-09755

HYDROGEOLOGY OF THE OBSERVATION WELL SITE AT THE U.S. GEOLOGICAL SURVEY NATIONAL CENTER, RESTON, VIRGINIA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W78-09757

NEBRASKA'S GROUND WATER MANAGEMENT ACT,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 6E.
W78-09763

EFFECTS OF PHOSPHATE MINERALIZATION AND THE PHOSPHATE INDUSTRY ON RADI-

UM-226 IN GROUND WATER OF CENTRAL FLORIDA,
Office of Radiation Programs, Las Vegas, NV.
For primary bibliographic entry see Field 5G.
W78-09800

4C. Effects On Water Of Man's Non-Water Activities

RELATION OF URBAN LAND-USE AND LAND-SURFACE CHARACTERISTICS TO QUANTITY AND QUALITY OF STORM RUNOFF IN TWO BASINS IN CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
M. A. Sylvester, and W. M. Brown, III.
Available from Supt. of Documents, GPO, Washington, DC 20402; Price, $2.00. Water-Supply Paper 2051, 1978. 49 p, 21 fig, 5 tab, 40 ref.

Descriptors: *Urban runoff, *Storms, *Discharge(Water), *Water quality, *Sediment transport, River basins, Pollutants, Topography, Land use, Effects, Evaluation, California, *San Francisco Bay area, *Sacramento-San Joaquin Delta area.

Two basins (Castro Valley Creek, in Alameda County, and Strong Ranch Slough, in Sacramento County) in the San Francisco Bay and Sacramento-San Joaquin Delta region (Bay-Delta region) were sampled intensively (3-15 minute intervals) during three storms between October 1974 and April 1975. Both basins are primarily residential, but the Strong Ranch Slough basin is almost entirely urbanized and nearly flat, while the Castro Valley Creek basin possesses some rural areas and slopes greater than 70 percent in the headwaters. Water discharge and concentrations of suspended solids, chemical oxygen demand, 5-day biochemical oxygen demand, nitrite and nitrate, total Kjeldahl nitrogen, total orthophosphorus, and setteable matter were usually greater at the Castro Valley Creek basin than at the Strong Ranch Slough basin. Concentrations of these constituents and water discharge changed more rapidly at the Castro Valley Creek basin than at the Strong Ranch Slough basin. Of the four subbasins sampled (two in each basin), constituent concentrations in runoff from a residential subbasin were usually greatest. (Woodard-USGS)
W78-09321

SEDIMENTATION RATES AND A REVISED SEDIMENT BUDGET FOR LAKE ERIE,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 2J.
W78-09339

SOIL WATER DEPLETION AFTER FOUR YEARS OF FOREST REGROWTH IN SOUTHWESTERN WISCONSIN,
North Central Forest Experiment Station, St. Paul, MN.
R. S. Sartz, and M. D. Knighton.
Department of Agriculture, Forest Service, Research Note NC-230, 3 p, 1978. 7 ref, 2 tab.

Descriptors: *Soil water, *Withdrawal, *Forests, *Vegetation regrowth, *Lumbering, Clear-cutting, Water storage, *Wisconsin, Percolation.

The effect of tree harvesting on water depletion from a 150-cm thick soil mantle does not appear to have diminished by the 7th year after the trees were cut. Mean seasonal depletion was 41, 64, and 146 mm for all vegetation removed, woody vegetation only removed, and uncut treatments, respectively. After 4 years of regrowth, the original bare and clearcut treatments depleted only 21 and 35% as much water as the uncut forest. (Witt-IPC)
W78-09524

CHARACTERIZATION AND IMPACT OF STORMWATER RUNOFF FROM VARIOUS LAND COVER TYPES,
Wiggins-Rimer and Associates, Durham, NC.
For primary bibliographic entry see Field 5B.
W78-09598

THE FLEXURAL MOTIONS OF A FLOATING ICE SHEET INDUCED BY MOVING VEHICLES,
Saskatchewan Research Council, Saskatoor..
For primary bibliographic entry see Field 2C.
W78-09643

SEDIMENT DISCHARGE FROM HIGHWAY CONSTRUCTION NEAR PORT CARBON, PENNSYLVANIA,
Geological Survey, Harrisburg, PA. Water Resources Div.
R. E. Helm.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-280 793, Price codes: A13 in paper copy, A01 in microfiche. Water-Resources Investigations 78-35, April 1978. 27 p, 19 fig, 6 ref.

Descriptors: *Sedimentation, *Land use, *Road construction, *Sediment discharge, *Storm runoff, Water quality, Turbidity, Color, Surface waters, Sediment transport, Suspended load, Sediment yield, *Pennsylvania, *Delaware River basin, Schuylkill County(Penn).

The effects of highway construction on suspended-sediment loads were studied in the upper reaches of the Schuylkill River basin, Schuylkill County, Pennsylvania, from April 1975 to March 1977. From March 1975 to October 1976, 4.3 miles of State Route 209 was relocated through the upper reaches of the basin, a mountainous watershed with a drainage area of 27.1 square miles. About 16,000 tons of suspended-sediment was discharged from the basin during the construction. The highway construction produced about 8,000 tons or 50 percent of the total sediment discharge. Steep slopes, the availability of fine coal wastes, coal-washing operations, and other land uses in the basin were responsible for most of the remaining sediment discharge. Seventy percent of the total suspended-sediment discharge occurred during eight storms. (Woodard-USGS)
W78-09750

4D. Watershed Protection

EROSION PROCESSES ON STEEP GRANITIC ROAD FILLS IN CENTRAL IDAHO,
Forest Service (USDA) Boise, ID. Intermountain Forest and Range Experimental Station.
For primary bibliographic entry see Field 2J.
W78-09330

PREDICTING BASE FLOW USING HYDROGEOLOGIC PARAMETERS,
Agricultural Research Service, Chickasha, OK. Southern Great Plains Watershed Research Center.
J. W. Naney, D. G. DeCoursey, B. B. Barnes, and G. A. Gander.
Water Resources Bulletin American Water Resources Association Vol. 14, No. 3, June 1978, p 640-650, 6 fig, 11 ref.

Descriptors: *Data flow, *Groundwater discharge, *Groundwater flow, *Forecasting, *Unit hydrograph, Solar radiation, Evaporation, Decomposition, Air temperature, Flow, Effluent streams, Soil moisture, Field capacity, Water permeability, Specific yield, Transmissivity, Gravitational flow, Watershed, *Recharge, *Water table, Tile, Discharge, Storage, Moisture content.

A method is presented for predicting base flow using easily measured, or estimated, hydrogeologic parameters. A mathematical model based upon the theory of subsurface flow to parallel drains is applied to a small watershed in Oklahoma. An example of model application is presented for a five-year period of record from this small watershed. Three years of data are used to calibrate the model, and two years of data are used for model validation. Hydrographs of observed and predicted base flow are presented for the five-year period of record. We concluded from this limited application of the model, on a small watershed, that the modeling techniques discussed herein were valid and should be tested for longer time periods on a larger watershed to determine their general applicability. (ARS)
W78-09334

SENSITIVITY OF OPTIMIZED PARAMETERS IN WATERSHED MODELS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W78-09345

A MOISTURE-ACCOUNTING WATERSHED MODEL FOR SINGLE-STORM EVENTS BASED ON TIME-AREA CONCEPT,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
For primary bibliographic entry see Field 2A.
W78-09351

AGRICULTURE RUNOFF MANAGEMENT (ARM) MODEL--VERSION II. REFINEMENT AND TESTING,
Hydrocomp, Inc., Palo Alto, CA.
For primary bibliographic entry see Field 5B.
W78-09444

NATURAL REFORESTATION RECLAIMS A WATERSHED: A CASE HISTORY FROM WEST VIRGINIA,
Sao Paulo Univ. (Brazil). Dept. de Silvicultura.
W. P. Lima, J. H. Patric, and N. Holowaychuk.
Department of Agriculture, Forest Service, Boomall, Penn., Northeastern Forest Experimental Station. Research Paper NE-392, 7 p, 1978. 2 fig, 23 ref, 3 tab.

Descriptors: *Small watersheds, *Streamflow, *Reforestation, Water yield, Land management, Soil erosion, Watersheds(Basins), *West Virginia, Hydrology, Farms, Land.

Thirteen years of hydrologic data from two contiguous small watersheds in West Virginia were analyzed to determine the effects on streamflow of natural reforestation on abandoned farmlands. From 1958 to 1970, streamflow on the watersheds was unchanged. The history of land use on the study area helps explain the apparent lack of hydrologic effects of reforestation. Aerial photographs taken in 1933, 1945, 1956, and 1968 documented the rapid advance of reforestation. Observations of streamflow began about 25 years after farming had terminated; any measurable hydrologic effects of natural reforestation probably occurred before these observations. (Witt-IPC)
W78-09525

FLUVIAL SEDIMENT IN OHIO,
Geological Survey, Lansing, MI. Water Resources Div.; and Geological Suvey, Columbus, OH Water Resources Div.
For primary bibliographic entry see Field 2J.
W78-09742

PREDICTION OF SEDIMENT TRANSPORT IN A GRASSED MEDIA,
Kentucky Univ., Lexington. Dept. of Agricultural Engineering.

B. J. Barfield, E. W. Tollner, and J. C. Hayes.
Paper No. 77-2023 presented at the 1977 Annual Meeting of the American Society of Agricultural Engineers, June 26-29, 1977, Raleigh, North Carolina, 23 p, 7 fig, 3 tab, 13 ref.

Descriptors: Model studies, Sediments, *Sediment control, Sediment loads, Sediment transport, Vegetation, *Vegetation effects, *Forecasting.

A steady state model is presented for determining the sediment filtration capacity of a grass media under varying flow rates, sediment loads, particle sizes, flow durations, channel slopes, and media density. It is possible to use the model to predict the required media spacing, channel slope, and length of media to give a desired outflow concentration for given flow conditions. (Skogerboe-Colorado State)
W78-09764

COMPARATIVE ERODIBILITY OF LOESS SOILS IN POLAND AND THE UNITED STATES,
Agricultural Research Service, Columbia, MO. North Central Watershed Research Center.
R. F. Piest, and S. Ziemnicki.
Paper No. 77-2511 presented at the 1977 Winter Meeting of the American Society of Agricultural Engineers, December 13-16, 1977. Chicago, Illinois, 29 p, 7 fig, 3 tab, 17 ref.

Descriptors: Erosion, *Soil erosion, *Iowa, *Sediment transport, Erosion control, *Erosion rates, *Poland.

Historic erosion patterns between loess soil regions of Poland and southwestern Iowa were compared. A rational interpretation of the measured soil losses reported by various researchers was attempted through application of the Universal Soil Loss Equation. Gullying rates and causes in both countries were examined. (Skogerboe-Colorado State)
W78-09766

EVALUATION OF WILD OAT STRAW AS A SOIL EROSION RETARDANT USING SIMULATED RAINFALL,
California Univ., Davis. Dept. of Land, Air and Water Resources.
M. J. Singer, and J. Blackard.
Agronomy Journal, Vol. 69, No. 5, p 811-814, September-October, 1977. 3 fig, 2 tab, 13 ref.

Descriptors: Erosion, *Soil erosion, Rainfall, *Oats, Runoff, Mulches, *Erosion control.

Soil cover is recognized as an important factor in soil erosion control. This study was made to determine the quantitative relationship between cover percent for one cover type and soil loss under simulated rainfall. Data from this experiment are used to calculate a cover coefficient for wild oat straw similar to the 'C' factor in the Wischmeier Universal Soil Loss Equation, The R, K, L, S, and P factors were kept constant during the experiments. A rainfall simulator was used in the laboratory to produce 30 min rainfall events of 76 mm/hour (3 in/hour) intensity on soil material at 9% slope. Under these conditions, wild oat straw significantly reduced sediment loss at cover levels of 50% or more. A significant reduction in runoff volume was observed for cover percentages exceeding 90%. (Skogerboe-Colorado State)
W78-09784

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1977--VOLUME 1. NEW YORK EXCLUDING LONG ISLAND.
Geological Survey, Albany, NY. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09313

CHEMICAL AND PHYSICAL QUALITY OF SELECTED PUBLIC WATER SUPPLIES IN FLORIDA, AUGUST-SEPTEMBER 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
G. A. Irwin, and H. G. Healy.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-281 504, Price codes: A10 in paper copy, A01 in microfiche. Water-Resources Investigations 78-21, March 1978. 200 p, 5 fig, 30 tab, 68 ref.

Descriptors: *Water quality, *Surface waters, *Groundwater, *Water supply, *Florida, Potable water, Water analysis, Sampling, Chemical analysis, Trace elements, Nutrients, Pesticides, Physical properties, Water treatment, Desalination, Evaluation.

Results of a 1976 water-quality reconnaissance made by the U.S. Geological Survey indicated that, with few exceptions, all public water supplies in Florida are of high quality and meet the standards set forth in the National Interim Primary Drinking Water Regulations. Occasionally the concentrations of fluoride, turbidity, cadmium, chromium, and lead approximated, equaled, or exceeded maximum contaminant levels with exceedences occurring very infrequently. The pesticides 2,4-D and silvex, were detected in some public supplies throughout the State mainly in surface water. Although pesticides were not detected in concentrations approaching the maximum levels established in the regulations, their presence does signal that the activities of man are beginning to affect some water resources. (Woodard-USGS)
W78-09320

ANALYTICAL IMPLICATIONS OF HARMONIZED MONITORING SCHEMES,
Water Research Centre, Medmenham (England). Water Quality and Health Div.
A. L. Wilson.
Journal of the Institution of Water Engineers and Scientists, Vol. 32, No. 1, p 57-66, January 1978. 13 fig.

Descriptors: *Water quaity, *Water analysis, *Coordination, *Monitoring, Measurement, Control, Statistical methods, Foreign research, Reliability, Quality control, Testing procedures, Methodology, Statistics, Testing, Analytical techniques, Analysis, Great Britain.

The harmonized monitoring scheme aims to ensure that analytical results meet specified standards of accuracy, and this requirement carries a number of important implications for the analyst. This paper considered a number of these implications within the general context of water quality measurement rather than for the harmonized monitoring scheme only. To achieve valid comparison of experimental estimates of the qualities of different waters, the natural spatial and temporal variability of quality must be taken into account, i.e., appropriate sampling positions, times, and frequencies must be used. If this is not done, these factors may have a greater effect on comparability than analytical factors. This paper was restricted to sample handling and analytical considerations, but the importance of the other aspects of sampling was emphasized. Many interlaboratory studies have shown that analytical errors not of a few per cent but of several hundred per cent may arise in some laboratories and that errors of 20 to 100% are common. On this basis, it is taken for granted in this paper that positive action generally is necessary to ensure comparability of results. (Humphreys-ISWS)
W78-09331

COLLABORATIVE TESTING OF A MANUAL SODIUM ARSENITE METHOD FOR MEASUREMENT OF NITROGEN DIOXIDE IN AMBIENT AIR,
Environmental Monitoring and Support Lab., Research Triangle Park, NC.
J. H. Margeson, J. C. Suggs, P. C. Constant, Jr., M. C. Sharp, and G. W. Scheil.
Environmental Science and Technology, Vol. 12, No. 3, p 294-297, March 1978. 2 fig, 3 tab, 8 ref.

Descriptors: *Nitrogen compounds, *Methodology, *Quality control, *Testing procedures, *Analytical techniques, *Kansas, Sodium arsenite, Gases, Testing, Monitoring, Evaluation, Statistics, Analysis, Measurement, Chemistry, Laboratory tests, Data collection, *Collaborative testing, *Nitrogen dioxide monitoring, *Kansas City(Mo).

The sodium arsenite method for 24-h integrated measurement of NO2 in ambient air was subjected to a collaborative test. Ten collaborators sampled ambient air and, simultaneously, the same ambient air spiked with a reliable source of NO2 for 4 days at a common site in Kansas City, Missouri. NO2 concentrations of 50-370 micrograms/cu m were sampled. Within and between laboratory standard deviations were 8 and 11 micrograms/cu m, respectively, over the range 84-312 micrograms NO2/cum. The method has a bias of -3% of the concentration over the above range. The lower detectable limit (LDL) of the method was 8 micrograms/cu m. The test results indicated that the method will produce accurate, precise measurements of ambient NO2 concentrations. (Henley-ISWS)
W78-09332

ANALYZER FOR CONTINUOUS DETERMINATION OF DISSOLVED OXYGEN, PH, ELECTRICAL CONDUCTIVITY, TEMPERATURE, AND TRANSPARENCY IN NATURAL WATERS,
Akademiya Nauk SSSR, Moscow. Inst. Geokhimii i Analiticheskoi Khimii.
L. G. Solov'yev, A. S. Ponomarev, V. G. Lazarev, and V. M. Kin.
Soviet Hydrology: Selected Papers, Vol. 15, No. 4, p 313-315, 1976. 4 fig, 1 tab, 7 ref. Translated from Gidrokhimicheskiye Materialy, Vol. 63, p 134-138, 1976.

Descriptors: *Water quality, *Sampling, *Ships, *Instrumentation, Equipment, Electronic equipment, Measurement, Surveys, Rivers, Dissolved oxygen, Hydrogen ion concentration, Electrical conductance, Water temperature, Turbidity, *USSR.

It is difficult to study the hydrochemical regime of natural waters without using automatic methods of analysis because of the large area natural waters occupy. Submerged or towed sensors are used widely in oceanography. The information from these sensors is recorded and analyzed on board ship. Such systems are inadvisable for the study of the hydrochemistry of rivers and polluted waters. It is better to use systems with continuous sample delivery to the ship's laboratory for monitoring some characteristics with a measuring device. Such systems have never been used in the Soviet Union, with the exception of some specialized instruments for monitoring individual parameters. Measurements in the Volga reach from

Kuybyshev city to Yakhrom city (Moscow Canal) were made continuously with the analyzer using the sampling device and a recorder. A record of many days of the pH, dissolved oxygen, electrical conductivity, transparency, and temperature was obtained. The measurements showed that these characteristics changed little in some river and reservoir reaches and considerably in others. The performed investigations testify to the advisability of automating continuous measurements for the study of the hydrochemical regime of natural waters. Automated systems do not preclude the use of standard methods of hydrochemical analysis but supplement them, help selecting ship's stations, and offer great possibilities for investigating the rapidly varying properties and composition of natural waters over larger areas. (Sims-ISWS)
W78-09338

ATMOSPHERIC LOADING OF PHOSPHORUS AND OTHER CHEMICALS TO LAKE MICHIGAN,
Minnesota Univ., Minneapolis.
For primary bibliographic entry see Field 5B.
W78-09340

THE ROLE OF STANDARD REFERENCE MATERIALS IN ENVIRONMENTAL MEASUREMENTS,
National Bureau of Standards, Washington, DC.
J. R. McNesby.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-256 893, Price codes: A02 in paper copy, A01 in microfiche. Proceedings National Conference on Health, Environmental Effects, and Control Technology on Energy Use, Report No. 600/776-002(Environmental Protection Agency), p 58-60, February 9-11, 1976. 1 tab.

Descriptors: *Standards, *Pollutants, *Air pollution, *Water pollution, *Energy, Materials testing, Water quality, Air environment, Materials, Clean Air Act, Public health, Environmental engineering, Pollution abatement, Environmental sanitation, Measurement, Publications, Reference materials, Certified standards.

The raionale for the importance of accurate as well as precise environmental measurement was presented. The role Standard Reference Materials is to provide the analyst with NBS certified samples to facilitate the ability to make accurate measurement. Available energy related Standard Reference Materials were listed, and those expected to be developed along with target dates were tabulated. (Henley-ISWS)
W78-09361

ATMOSPHERIC SCAVENGING OF HYDROCHLORIC ACID,
Illinois Inst. of Tech. Research Inst. Chicago.
E. O. Knutson, and D. L. Fenton.
Available from the National Technical Information Service, Springfield, VA 22161 as N75-30670, Price codes: A05 in paper copy, A01 in microfiche. NASA CR-2598, August 1975. 76 p, 16 fig, 13 tab, 33 ref, 3 append. NAS8-30807.

Descriptors: *Environmental effects, *Washouts, *Air pollution, *Pollutants, *Water pollution, Chemical properties, Acids, Water chemistry, Water properties, Environment, Ecology, Atmosphere, Fallout, Precipitation(Atmospheric), Water pollution sources, Water quality, Acidity.

The scavenging of hydrogen chloride from a solid rocket exhaust cloud was investigated by an experiment in which water drops were caused to fall at terminal velocity through a confined solid rocket exhaust cloud. The water drops were collected and analyzed to determine the amount of HCl captured during fall. The concentration of HCl within the chamber during the time of the scavenging experiment was measured by means of bubblers. Tests showed that the measured chamber HCl concentration, together with the measured HCl deposition on the chamber walls, accounted for 81 to 94% of the theoretical HCl. This mass balance lends confidence to the measurement techniques. It was found that the HCl captured by water drops during fall is approximately one-half that predicted by the classical Frossling correlation, which applies to water drops falling through a 'clean' HCl cloud. No effect of humidity n the scavenging efficiency was detected. The humidity range covered was 69-98%. The experimental scavenging results for 0.9 mm drops was extended mathematically to cover natural rains. An example calculation for scavenging of HCl from a solid rocket exhaust cloud was given using an idealized Kennedy Space Center rain cycle. This cycle contains an aggregate of two hours of light rain (6.4 mm/hr), 15 minutes of medium rain (24 mm//hr), and five minutes of heavy rain (55 mm/hr). It was calculated that this rain cycle would reduce the cloud HCl concentration to 20.6% of its value in the absence of rain. (Henley-ISWS)
W78-09362

SIMULTANEOUS DETERMINATION OF TRACE METALS IN INDUSTRIAL AND DOMESTIC EFFLUENTS BY DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY,
Benedict Coll., Columbia, SC. Dept. of Chemistry.
J. T. Kinard.
Journal of Environmental Sciences and Health, Vol. A12, No. 10, p 531-547, 1977. 3 fig, 6 tab, 12 ref.

Descriptors: *Analytical techniques, *Trace elements, *Digestion, *Anodes, *Electrochemistry, Spectrophotometry, Zinc, Cadmium, Copper, Lead, Electrodes, Domestic wastes, Industrial wastes, Measurement, Waste water treatment.

Differential pulse anodic stripping voltammetry, following Parr acid digestion bomb treatment, was tested for the simultaneous analysis of trace metals in industrial and domestic wastes. Effluent from textile, printing, meat packing, slaughter house, soft drink, dyeing and finishing, steel mill, aluminum, egg processing, and chicken farm industries and domestic wastes were placed as 0.1-10 ml samples in a Teflon digestion cup containing 2.5-3 ml nitric acid and heated to 200C. The samples were heated 2-7 hrs, cooled, and diluted with sodium acetate to pH 5.5-5.8. The solutions were purified on a Chelex 100 column and placed in an electrolysis cell for analysis. Recovery of zinc, cadmium, lead, bismuth, and copper during simultaneous determinations by the differential pulse anodic stripping voltammetry technique ranged from 93.9-107%. The technique was superior to atomic absorption in terms of detection limits, sensitivities, and cost. (Lisk-FIRL)
W78-09400

BIODEGRADABILITY TESTING AND ITS RELEVANCE TO ENVIRONMENTAL ACCEPTABILITY,
Unilever Ltd., Port Sunlight (England). Unilever Research Lab.
P. A. Gilbert, and G. K. Watson.
Tenside Detergents, Vol. 14, No. 4, p 171-177, 1977. 3 tab, 36 ref.

Descriptors: *Biodegradation, *Analytical techniques, *Microbial degradation, *Oxidation, *Inhibition, Activated sludge, Chemical oxygen demand, Carbon, Biomass, Cultures, Waste water treatment, Municipal wastes.

Definitions, techniques, and limiting parameters of biodegradability of municipal waste water are reviewed. Distinctions are made between biodegradation, biodegradability, functional biodegradation, environmentally acceptable biodegradation, ultimate biodegradation, complete mineralization, bio-elimination, biological hardness, and biological softness. Definitions are also provided for elimination, acclimatization, biomass, constitutive enzymes, dieaway testing, enrichment or elective culture techniques, inducible, enzymes, inoculation, inoculum, and substrate. Conditions influencing biodegradation include: acclimatization, enzymatic co-oxidation, waste concentration inhibition, temperature, pH, inorganic salt composition and concentration, and the presence of certain compounds during testing. Test methods are classified as: die-away techniques where only the test compound is present; die-away techniques, where other organic carbon sources besides the test compound are present; and activated sludge techniques. Analytical techniques include specific chemical analysis for each compound, radio-labelled compound, oxygen uptake and carbon dioxide generation, dissolved organic carbon, COD, biomass, and pure culture analysis. Limitations, advantages, and selection of the testing procedures are reviewed. (Lisk-FIRL)
W78-09402

THE BACTERIAL METABOLISM OF 4,4'-DICHLOROBIPHENYL, AND ITS SUPPRESSION BY ALTERNATIVE CARBON SOURCES,
Amsterdam Univ., (Netherlands). Lab. of Environmental and Toxicological Chemistry.
For primary bibliographic entry see Field 5D.
W78-09404

ISOLATION OF SALMONELLA FROM SEWAGE WITH A NEW PROCEDURE OF ENRICHMENT,
Hellenic Pasteur Inst., Athens (Greece).
P. Vassiliadis, D. Trichopoulos, A. Kalandidi, and E. Virouchaki.
Journal of Applied Bacteriology, Vol. 44, No. 2, p 233-239, 1978. 3 tab, 13 ref.

Descriptors: *Salmonella, *Cultures, *Sewage bacteria, *Sampling, *Isolation, Competition, Data collections, Incubation, Pathogenic bacteria, Sewers, Pollutant identification, Analytical techniques, Waste water disposal, Municipal wastes.

A total of 151 strains of salmonellae belonging to 27 serotypes were isolated by three enrichment methods using municipal wastes samples collected from the sewer system in Athens, Greece. Sewer samples collected by 40 gauze-wrapped Moore swabs were incubated in 200 ml buffered peptone broth for 18-22 hrs at 37C; 0.1 ml aliquots of the peptone media were then enriched at 37C for 48 hrs in Rappaport's medium formula R25, at 43D for 48 hrs in R10 medium, or at 34C for 48 hrs in Muller-Kauffmann's tetrathionate broth. Subcultures were derived for each of these enrichment media on brilliant green-deoxycholate agar and incubated for 24 hrs at 37C. Of the 27 serotypes isolated, four were formerly unreported in Athens' sewage. The Rappaport enrichment media isolated more serotypes and strains than the tetrathionate broth. R10 at 43C isolated 103 strains and 24 serotypes; R25 at 37C isolated 82 strains and 19 serotypes; and M-K tetrathionate broth isolated 25 strains and 11 serotypes. While the R10 medium yield more salmonellae serotypes and strains, the growth of competing organisms was inhibited in this media compared to the other two media. Smaller quantities of inoculum were required for the Rappaport enrichment media. (Lisk-FIRL)
W78-09406

QUANTITATIVE ANALYSIS OF HYDROCARBONS IN SEWAGE SLUDGE FROM WASTE WATER PURIFICATION STATIONS,
Institut d'Hygiene, Geneva (Switzerland). Service de Toxicologie Industrielle, d'Analyse de l'Air et de Protection Center le Bruit.
J. C. Landry, and J. Dennemont.
Travaux de Chimie Alimentaire et d'Hygiene, Vol 69, No 1, p 96-108, 1978. 6 fig, 2 tab, 9 ref.

Descriptors: *Organic compounds, *Analytical techniques, *Gas chromatography, *Sewage sludge, *Hydrolysis, Separation techniques, Chemical analysis, Pollutant identification, Solvents, Waste water treatment, Municipal wastes.

A gas chromatography technique, incorporating pentane-benzene elution and pentadecane as an internal standard, permitted polycycic aromatic hydrocarbon quantification in sewage sludge samples with varying solids contents. The technique, which employed direct hydrolysis of sewage sludges containing 40-95% water rather than Soxhlet extraction, was tested on sludge samples obtained from five Swiss waste water treatment plants. A 10 g sample of sludge was homogenized and hydrolyzed with a 30 ml solution of methanolic potassium hydroxide for 1.5 hrs, followed by the addition of 25 ml pentane. Duplicate sludge samples were mixed with pentane and 0.25 micrograms pentadecane to provide an internal standard. In some of the samples, pentane elution was incomplete and a pentane-benzene solution was added to elute polar hydrocarbons. The sample was filtered, adjusted to pH 2.5, and extracted with 25 ml pentane. The sample was then placed in a column containing 40 g activated silica gel in pentane, eluted with 250 ml pentane-benzene, concentrated to 0.2-1.0 ml, and analyzed by gas chromatography at 120-320C. The total areas of the sample peaks were compared to corresponding pentadecane peaks, employed as an internal standard. Results correlated well with predicted surface areas when high concentrations of hydrocarbons were present. Hydrocarbon recovery ranged 96.0-98.9% in samples bearing more than 50% solids. (Lisk-FIRL)
W78-09407

RECOVERY OF ASCARIS EGGS FROM SLUDGE,
Cincinnati Univ., OH. Dept. of Biological Sciences.
K. B. Meyer, K. D. Miller, and E. S. Kaneshiro.
Journal of Parasitology, Vol. 64, No. 2, p 380-383, April, 1978. 2 tab.

Descriptors: *Animal parasites, *Analytical techniques, *Detergents, *Volumetric analysis, *Sewage sludge, Centrifugation, Membrane processes, Filtration, Pollutant identification, Waste water treatment, Municipal wastes.

The zinc sulfate concentration technique for quantifying Ascaris ova in sewage sludge was enhanced by pretreatment with hypochlorite and an anionic detergent. A 75 g sample of mixed sludge seeded with Ascaris eggs was mixed with 100 ml of 2.62% hypochlorite, swirled, mixed with additional hypochlorite to obtain a 225 ml volume, and allowed to react for 50 min. The sample was centrifuged at 4C for 2 min and the solids fraction was mixed with 2 ml of anionic detergent and distilled water to a 225 ml volume. The mixture was centrifuged again, washed twice with distilled water, mixed with 75 ml of 33.2% zinc sulfate solution, and then centrifuged. The supernatant containing the eggs was passed through an 0.45 micron membrane filter; the recovered eggs were incubated in the dark for 10 days at 25C. The hypochlorite and anionic detergent treatment recovered 71% of the eggs, compared to 38% recovery with hypochlorite alone. Higher recovery rates were obtained when larger quantities of eggs were seeded in the sludge. Hypochlorite did not interfere with egg viability or destroy nonviable eggs. (Lisk-FIRL)
W78-09408

PRACTICAL METHOD FOR DETECTING POLIOVIRUS IN ANAERobic DIGESTER SLUDGE,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Science and Engineering.
J. S. Glass, R. J. Van Sluis, and W. A. Yanko.
Applied and Environmental Microbiology, Vol. 35, No. 5, p 983-985, 1978. 2 tab, 10 ref.

Descriptors: *Viruses, *Anaerobic digestion, *Sound waves, *Flocculation, *Separation techniques, Cultures, Toxicity, Heavy metals, Diseases, Pollutant identification, Sludge digestion, Dewatering, Waste water treatment, Municipal wastes.

Poliovirus was eluted from anaerobic digested sludge and dewatered composted sludge with beef extract addition, sonic disruption, and dithizone-chloroform extraction. A 47% poliovirus recovery was achieved when 10 mg sludge solids were suspended in 200 ml of 3% beef extract, disrupted by sonic treatment for 2 min, and centrifuged for 20 min; eluted viruses were assayed on monolayers of Buffalo green monkey kidney cells cultured in a medium with 10% fetal bovine serum. Virus recovery was increased to 60-65% when the beef extract eluates were concentrated to 8-12 ml by organic flocculation. The poliovirus isolation frequency was 100% when the elution and concentration method was applied to undigested liquid sludge, digested liquid sludge, and dewatered digested sludge. Poliovirus isolation in dewatered digested sludge, composted for 6 or more days, was limited because of mammalian monolayer cell death attributed to toxic concentrations of heavy metals formed by organic flocculation of digester solids eluates. Detoxification of the cytotoxic concentrates was achieved by extraction of the concentrated eluates with dithizone in chloroform. Poliovirus recovery after solvent extraction averaged 98.9%. The elution-concentration-extraction technique had a detection limit of about 1 infective virus unit/concentrated sample. (Lisk-FIRL)
W78-09409

TEHRAN GROUND WATER POLLUTION BY DETERGENTS,
Tehran Univ. (Iran). Dept. of Environmental Health.
K. Imandel, N. Razeghi, and P. Samar.
Water, Air, and Soil Pollution, Vol. 9, No. 1, p 119-122, January, 1978. 2 fig, 3 ref.

Descriptors: *Detergents, *Colorimetry, *Groundwater, *Aquifer testing, *Volumetric analysis, Analytical techniques, Water quality standards, Water wells, Sampling, Water pollution, Impaired water quality, Municipal wastes.

Detergent concentrations in groundwater aquifers were analyzed in 316 wells with depths ranging from 8-330 m in Tehran, Iran. Samples were analyzed by the methylene blue colorimetric technique; calibration curves were calculated by the least squares method. Detergent concentrations in samples collected over a 10-mo period ranged from traces to 1.403 mg/liter. The average concentration of detergents, within a confidence limit of 95% and a permissible error of plus or minus 0.005, was calculated at 0.1163-0.1593 mg/liter as methylene blue active substance. The United States and the World Health Organization permit detergent concentrations of 0.5-1.0 ppm in drinking water, below Tehran sampled concentrations. An isoconcentration map of detergent concentration distribution revealed localization in industrial and urban areas. (Lisk-FIRL)
W78-09421

APPLICATION AND DETERMINATION OF ORGANIC POLYMERS,
Stevens Inst. of Tech., Hoboken, NJ.
For primary bibliographic entry see Field 5D.
W78-09440

SUSCEPTIBILITY OF THREE FAMILIES OF FRESHWATER FISH TO DIELDRIN (IN SPANISH),
V. Canestr.
Mem Soc Cienc Nat La Salle 35(102), p 301-308, 1975.

Descriptors: *Characidae, *Cichlidae, *Insecticides, *Pimelodidae, *Dieldrin, Freshwater fish, Bioassay, Water pollution effects.

Acute bioassays were performed to determine the relative susceptibility of representatives of families Characidae, Cichlidae, and Pimelodidae to sub-lethal doses of dieldrin. Susceptibility was similar in systematic groups in the same family. Susceptibility was greater in Characidae than in Cichlidae, Pimelodidae being the least susceptible. Species difference among the same families were small.--Copyright 1978, Biological Abstracts, Inc.
W78-09491

COMPARATIVE MEASUREMENTS OF CHEMICAL OXYGEN DEMAND OF KRAFT PULP MILL EFFLUENTS VIA THE DICHROMATE AND PERMANGANATE METHODS (MEDIDAS COMPARATIVAS DE LA DEMANDA QUIMICA DE OXIGENO AL DICROMATO Y LOS INDICES DE PERMANGANATO. EN EFLUENTES DE FABRICACION DE PASTA KRAFT),
Instituto Nacional de Investigaciones Agrarias, Madrid (Spain).
D. Garcia Martin, R. M. Caminos Muruzabal, and M. Concepcion Garcia Vallejo.
Investigacion y Tecnica del Papel, Vol 14, No 54, p 985-1005, October, 1977. 1 appendix, 1 illus, 8 ref, 8 tab. English summary.

Descriptors: *Pulp wastes, *Chemical oxygen demand, *Water analysis, Testing procedures, Wastes, Industrial wastes, Water pollution sources, Organic matter, Pulp and paper industry, Analytical techniques, Water chemistry, Water properties, Testing, Chemical analysis, Kraft mills, Permanganates, Dichromates.

A comparison of dichromate and permanganate methods for determining the oxidizability of organic materials in kraft mill effluents indicated the Leithe modification of the dichromate method to be preferable to the standard procedure, and the acid permanganate method to be preferable to the alkaline permanganate method. (Speckhard-IPC)
W78-09507

IDENTIFICATION OF SOME NEUTRAL CHLORINATED ORGANIC COMPOUNDS IN SPENT BLEACH LIQUORS,
Swedish Forest Products Research Lab., Stockholm.
K. Lindstrom, and J. Nordin.
Svensk Papperstidning, Vol. 81, No. 2, p 55, February 10, 1978. 3 ref, 1 tab.

Descriptors: *Bleaching wastes, *Waste identification, *Chlorine compounds, Pulp waste, Wastes, Industrial wastes, Water pollution sources, Pollutant identification, Gas chromatography, Spectroscopy, Pulp and paper industry, Organic compounds, Aromatic compounds.

Eighteen neutral organic chlorine compounds were identified in the ether-soluble fraction of chlorination-stage kraft pulp bleaching effluent by means of gas chromatography/mass spectrometry techniques. Most of these compounds amounted to less than 0.1 g/ton of bleached pulp. The 18 compounds include trichloro-allene, tetra- and pentachloropropene, monochloroacetylfuran, mono- and dichloro-8-hydroxycymene, tri- and tetrachlorothiophene, di- and trichloroformylthiophene, di- and trichloroacetylthiophene, dichloropropionylthiophene, monochlorobenzaldehyde, trimethoxytrichlorobenzene, and mono-, di-, and trichloropyrone. (Brown-IPC)
W78-09512

ANALYSES OF PAPER MACHINE WATERS WITH ION SPECIFIC ELECTRODES. PART III. VARIOUS MEASUREMENT METHODS USING CHLORIDE ION SPECIFIC ELECTRODE,
Valmet Oy., Jyvaskyla (Finland).
J. Korhonen, and P. O. Lumme.

Paperi ja Puu, Vol 59, No 9, p 558-560, 563-565, September, 1977. 6 fig, 11 ref, 8 tab.

Descriptors: *Water analysis, *Chlorides, *Pulp wastes, *Electrodes, Ions, Sodium chloride, Analytical techniques, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Storage, Waste storage, Volumetric analysis, Calibrations, White water(Paper machines), Sodium nitrate, Hydrogen sulfide.

A chloride-specific electrode was used to determine chloride concentrations in samples of two paper-machine white waters, using direct calibration with pure NaCl solutions, calibration with NaCl solutions plus ionic strength adjustment, silver nitrate titration, and the method of known addition. The calibrations methods and the method of known addition gave too high chloride concentrations when applied to samples containing hydrogen sulfide. For sulfide-free samples all methods produced satisfactory results. The effect of hydrogen sulfide on accuracy of measurements was studied by storing samples in airtight bottles and conducting analyses at weekly intervals. (See also W74-11094 and W74-11093) (Brown-IPC)
W78-09523

PHYSICO-CHEMICAL SURVEILLANCE DATA OBTAINED FOR LAKE ONTARIO, 1974 AND THEIR RELATIONSHIP TO CHLOROPHYLL A,
Canada Centre for Inland Waters, Burlington (Ontario).
For primary bibliographic entry see Field 5C.
W78-09539

BIOASSAY STUDIES ON THE TOXICITY OF FISH OF DISTILLERY EFFLUENTS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Zoology-Entomology.
For primary bibliographic entry see Field 5C.
W78-09544

OLIGOCHAETES (OLIGOCHAETA) OF SOME STREAMS OF THE HIGH TATRA MTS AND THE RIVER BIALKA TATRZANSKA,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
For primary bibliographic entry see Field 5C.
W78-09546

IMPROVED METHODS OF OIL-IN-WATER ANALYSIS,
General Motors Corp., Detroit, MI. Detroit Diesel Allison Div.
P. P. Cook, P. M. Duvall, and R. C. Bourke.
Water and Sewage Works, Vol. 125, Reference Number, p 71-72, 74, 76, 78, April, 1978. 9 fig, 2 tab, 2 ref.

Descriptors: *Analytical techniques, *Oily water, *Infrared radiation, *Attenuation, *Oil wastes, Solvents, Measurement, Equipment, Pollutant identification, Analytical techniques, Instrumentation, Separation techniques, Waste water treatment, Industrial wastes.

The reference gravimetric method for calculating total oil and grease in water was modified to correlate with calibrations of the semi-automatic Horiba OCMA-200 oil monitoring device. Oil in water was measured with the Horiba unit by injecting a 10 ml sample of oily water with 10 ml Freon as a solvent into an extraction chamber and mixing the substances with a vibrating plunger. After mixing, the water and solvent were allowed to separate; the solvent was filtered into an infrared chamber; and the amount of 3.5 micron light attentuation caused by the oil was measured over 30 min. The STORET 00556 reference method utilized 30 ml of Freon for eac of these sample extractions over 6 min. This method was modified by adding 150 ml solvent for each extraction and increasing the extraction time to 45-60 min for 80% of the oil. The flask used in the reference method was predried at 200C, stored in a desiccator, and weighed on a silica-bearing desiccating balance to determine tare weight at equilibrium. This procedure prevented errors in weight determination due to moisture adsorption. Calibrations were more accurate when the extraction timer was removed from the Horiba unit, the pH was adjusted to 2, the internal solvent heater was disconnected, and the cover was removed during measurements. (Lisk-FIRL)
W78-09561

DETECTION OF VIRUSES IN WATER OF THE BALTIC SEA (IN GERMAN),
Kiel Univ. (West Germany). Abt. Hygiene and Microbiologie.
J. Steinmann.
Zentralbl Bakteriol Parasitenkd Infektionskr Hyg Erste Abt Orig Reihe B Hyg Betriebshyg Praev Med 164(5/6), p 492-497, 1977.

Descriptors: Enterovirus, E. coli, Outfalls, Picornavirus, Sewage, *Viruses, *Baltic Sea, *Pollutant identification.

Virological examination of water of the Baltic Sea in the neighborhood of a sewage outfall was done. By means of an apparatus for concerntrating viruses in water, it was possible to detect enteroviruses in 4 to 11 samples. The amount of viruses varied from 5-125 pfu (plaque forming units) in 101; the ratio of virus to Escherichia coli titer varied from 1:11, 111 to 1:1000,000. Factors influencing the decrease of virus titer in seawater were briefly discussed.--Copyright 1978, Biological Abstracts, Inc.
W78-09563

THE DEGRADATION OF AN AZO DYE IN AQUEOUS SOLUTIONS BY HIGH-INTENSITY ELECTRON-BEAM IRRADIATION,
Japan Atomic Energy Research, Takasaki. Takasaki Radiation Chemistry Research Establishment.
For primary bibliographic entry see Field 5D.
W78-09566

COOLING TOWER ENVIRONMENT--1978 (WITH SUPPLEMENT).
Maryland Univ., College Park. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 149, Price codes: A23 in paper copy, A01 in microfiche. Proceedings of Symposium on Environmental Effects of Emissions, held May 1978. 544 p, Supplement separately bound, Co-chairmen: Richard S. Nietubiez and R. Lamar Green. OWRT A-999-MD(13).

Descriptors: *Cooling towers, *Emissions, Drift, *Drift eliminators, *Drift prediction, Drift measurement, *Drift effects, Vegetation, Soils, Saline aerosols, Fluorescent dyes, Plume modeling, Airborne monitoring, *Ecological effects, Simulated drift, Reviews, Technology, Conferences, Air pollution effects, Salts, *Model studies, *Vapor plumes, Path of pollutants, Environmental effects.

Wet cooling towers provide a means of discharging to the atmosphere waste heat from industrial operations including electric generating plants. Heat is discharged from these towers resulting in a warm moist plume with entrained droplets (drift) of circulating water. The drift droplets will contain the minerals in the circulating water which will be deposited downwind of the cooling tower. The environmental impact of these emissions has not yet been adequately documented. A Symposium was held at the University of Maryland at College Park May 2-4, 1978 to bring together principal investigators involved in research on the environmental impact of cooling tower drift emissions. Thirty-three papers were presented portraying current state-of-the-art for cooling tower technology including drift eliminators design, plume modeling, predictions of drift deposition and ecological effects and field measurements to verify such predictions. In particular, recent results from the Maryland Chalk Point Cooling Tower Project were presented. These data show that under the somewhat limited peak load mode of operation of the generating unit with cooling tower no measurable environmental effect of deposition from cooling tower emissions has been found. However, research with simulated drift emissions in excess of predicted emissions from full load operations will cause damage to annual crops and perennial vegetation. Threshold levels for unacceptable levels of damage have not been established.
W78-09570

THIN-LAYER CHROMATOGRAPHIC DETERMINATION OF BENZO(A)PYRENE AND OTHER POLYCYCLIC AROMATIC HYDROCARBONS (IN RUSSIAN),
Academy of Medicine, Sofia (Bulgaria). Center for Hygiene.
R. Vasileva.
Gig Sanit (4), p 74-75, 1977.

Descriptors: Anthracene, *Pyrenes, *Aromatic hydrocarbons, *Chromatography(Thin-layer), *Pollutant identification, Methodology, Analytical techniques.

The TLC method uses a combination of cellulose, aluminum oxide, gypsum, liquid paraffin and benzene as absorbent. The sensitivity of the method is 1 ng for benzo(a)pyrene and 50 ng for anthracene, pyrene and 1,2,5,6-dibenzanthracene. A combination of TLC with spectrophotometry results in 92-97% determination.--Copyright 1978, Biological Abstracts, Inc.
W78-09587

THE SOLUBILITY OF AROCLOR 1254 IN SEA-WATER,
Oregon State Univ., Corvallis. School of Oceanography.
C. S. Wiese, and D. A. Griffin.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 4, April, 1978, p 403-411, 1 fig, 3 tab, 15 ref. Office of Sea Grants 2-37187 and 04-3-1854, NSF-IDOS GX-37350 USPHS ES-00210.

Descriptors: *Water pollution sources, *Water chemistry, *Polychlorinated biphenyls, Sea water, Analytical techniques, Solubility, *Pollutant identification, *Aroclor 1254.

Interest in the determination described in this paper derived from experiments designed to test the effects of polychlorinated biphenyl compounds on marine animals. Seawater was autoclaved, Aroclor 1254 was added, and the mixture was stirred. A standard solution of the Aroclor 1254 was analyzed by microcoulometric gas chromatography. The chlorine content of each major peak was determined by GLC-MS and referenced to a technique of Webb and McCall (1972). The equilibrium concentration of Aroclor 1254 in membrane filtered seawater was 28.1 + or - 1.8 ppb at 16.5C. In seawater which had been both membrane and carbon filtered the equilibrium concentration was 24.7 + or - 2.3 at 16.5C. These values are lower than those reported in the literature and it is suggested that four factors (stirring, salinity, organic content, and temperature) may be responsible for this difference with stirring having the most impact. (Chilton-ORNL)
W78-09589

THE TOXICITY OF MCPA TO FISH. LIGHT AND ELECTRON MICROSCOPY AND THE CHEMICAL ANALYSIS OF THE TISSUE,
Jyvaskyla Univ., (Finland). Dept. of Chemistry.
For primary bibliographic entry see Field 5C.
W78-09592

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1977--VOLUME 2. ST. LAWRENCE RIVER BASIN.
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09738

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1977--VOLUME 1. OHIO RIVER BASIN.
Geological Survey, Columbus, OH. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09739

WATER RESOURCES DATA FOR KANSAS, WATER YEAR 1977.
Geological Survey, Lawrence, KS. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09740

SUMMARY OF WATER RESOURCES FOR THE CAMPO, CUYAPAIPE, LA POSTA, AND MANZANITA INDIAN RESERVATIONS AND VICINITY, SAN DIEGO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09746

SELECTED HYDROLOGIC DATA, YAMPA RIVER BASIN AND PARTS OF THE WHITE RIVER BASIN, NORTHWESTERN COLORADO AND SOUTH-CENTRAL WYOMING,
Geological Survey, Denver, CO. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09748

IDENTIFICATION, INDEXING AND EXCHANGE OF DATA ON ENVIRONMENTAL POLLUTANTS,
Geological Survey, Reston, VA. Water Resources Div.
G. L. Thompson.
In: Proceedings, 4th Joint Conference on Sensing of Environmental Pollutants, held in New Orleans, Louisiana, November 6-11, 1977. American Chemical Society, p 238-240, 1978. 1 ref.

Descriptors: *Data storage and retrieval, *Hydrologic data, Water resources, *Water pollution sources, *Pollutants, Environmental effects, Indexing, Monitoring, Networks, Computers, Information retrieval, Information exchange, *Environmental pollutants, *Data base, *National Water Data Exchange.

The services rendered by the National Water Data Exchange (NAWDEX) Program are designed to facilitate effective support to environmental water-data indexing, and to disseminate data vital to programs concerned with environmental water pollution abatement. NAWDEX has amassed a large amount of environmental information on available water data and has access to extensive data resources and services available through its member organization. The ability of NAWDEX to provide assistance in locating and acquiring needed water data continues to improve as new data resources and services become available through interaction with new member organizations. The program represents a concerted effort to improve the quality and efficiency of data access and transfer from collectors to users. This effort improves communication throughout the water-data community, stimulates awareness of existing water data, provides data-search assistance more readily to those who need it, reduces the time and cost required to obtain data, increases the utilization of existing water data, helps to reduce redundancy in data collection, and facilitates resources-development planning for special monitoring, network design, and water-data management. (Woodard-USGS)
W78-09749

HYDROLOGIC DATA FOR MOUNTAIN CREEK, TRINITY RIVER BASIN, TEXAS, 1976,
Geological Survey, Austin, TX. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09751

GEOCHEMICAL AND HYDROLOGIC DATA FOR WELLS AND SPRINGS IN THERMAL-SPRING AREA OF THE APPALACHIANS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09754

FIELD AND LABORATORY PROTOCOLS FOR EVALUATING THE EFFECTS OF CHEMICAL SUBSTANCES ON AQUATIC LIFE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
For primary bibliographic entry see Field 5C.
W78-09796

5B. Sources Of Pollution

APPLICATION OF AN OIL SPILL VULNERABILITY INDEX TO THE SHORELINE OF LOWER COOK INLET, ALASKA,
South Carolina Univ., Columbia. Dept. of Geology.
J. Michel, M. O. Hayes, and P. J. Brown.
Environmental Geology, Vol. 2, No. 2, p 107-117, 1978. 8 fig, 3 tab, 7 ref.

Descriptors: *Oil spills, *Oil pollution, *Alaska, *Exploration, *Drilling, Oil wells, Coasts, Beaches, *Shores, *Berms, Geomorphology, *Terrain analysis, *Geological surveys, *Sediments, Oil, Environmental effects, Water pollution sources, Geology, *Cook Inlet(Alas).

Offshore tracts in Alaska's lower Cook Inlet are scheduled to be opened for exploratory petroleum drilling in the near future. Because of the potential for oil spills resulting from this activity, a field study of the coastal zone was conducted in June 1976. A total of 1216 km of shoreline was classified into 3 types: erosional (45 percent), neutral (38 percent), and depositional (17 percent). This classification was used in conjunction with a vulnerability index of potential oil spill damage, developed through study of three major oil spills, to predict the longevity of oil in the different coastal environments of the Inlet. We propose that the use of this type of vulnerability indexing, in conjunction with a biological susceptibility index and oil spill trajectory models, would provide a rational basis for decision making concerning the location of on- and off-shore oil facilities and the design of oil spill contingency plans. (EIS-Deal)
W78-09301

EFFECTS OF IRRIGATION ON WATER QUALITY IN THE SAND PLAIN OF CENTRAL WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
S. M. Hindall.
Wisconsin Geological and Natural History Survey, Madison Information Circular No 36, February 1978. 50 p, 20 fig, 1 plate, 3 tab, 34 ref.

Descriptors: *Water pollution sources, *Groundwater, *Surface waters, *Fertilizers, *Pesticides, Nutrients, Irrigation effects, Water quality, Path of pollutants, *Wisconsin, Central Wisconsin sand plain.

The abnormal occurrence of nutrients and pesticides in ground and surface waters of the sand plain of central Wisconsin reflects intensive farming and heavy chemical application. Concentrations of nitrogen, the primary nutrient, in ground water in irrigated areas are about twice as high as in the nonirrigated areas, and about four times greater than the State average. The nutrients, phosphorus and potassium, are present only in low concentrations. High concentrations of iron in ground water is the only area-wide problem encountered. Except for a few constituents, chemical quality of surface water in the study area is essentially the same as that for ground water. Heavy pesticide use is not reflected in the waters of the area. A single pesticide, DDT, was detected in the ground water, whereas DDT, DDE, diazinon, and 2,4,5-T, were detected in the surface water. Distinct seasonal or general trends in either ground-water or surface-water quality were not evident during the study. Data collected indicate the water quality is stable. Present agricultural practices do not appear to be causing further changes in water quality. (Woodard-USGS)
W78-09306

RELATION OF URBAN LAND-USE AND LAND-SURFACE CHARACTERISTICS TO QUANTITY AND QUALITY OF STORM RUNOFF IN TWO BASINS IN CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 4C.
W78-09321

ATMOSPHERIC LOADING OF PHOSPHORUS AND OTHER CHEMICALS TO LAKE MICHIGAN,
Minnesota Univ., Minneapolis.
S. J. Eisenreich, P. J. Emmuling, and A. M. Beeton.
Journal of Great Lakes Research, Vol. 3, No. 3-4, p 291-304, December 1977. 8 fig, 8 tab, 37 ref. EPA No. R 803238.

Descriptors: *Great Lakes, *Lake Michigan, *Fallout, *Water pollution sources, *Phosphorous, On-site data collections, Precipitation(Atmospheric), Sampling, Pollutants, Calcium, Magnesium, Potassium, Sodium, Sulfates, Silica, Chlorides, Rainfall, Analysis, Analytical techniques, Hydrogen ion concentration, Spatial distribution, Temporal distribution, Organic carbon.

Bulk precipitation was collected on a monthly basis in the Lake Michigan basin for 18 months during 1975-1976 to determine atmospheric total phosphorus (TP) loadings to Lake Michigan. The sampling network consisted of bulk collectors at 23 land stations and 2 in-lake buoys located off urban and rural areas. Annual TP loading to Lake Michigan for 1976 based on loading rates of 0.184 and 0.303 micro grams/sq cm/mo for the north and south basins, respectively, was 1,690,000 Kg/year, representing approximately 16% of the total P budget. North and south basins showed different TP loading properties with approximately 62% depositing in the south basin. Seasonal variations in loading rates showed maxima in late spring and early summer, and minima in winter. In-lake buoy samplers yielded enhanced loading of TP compared to land stations. Wet-only precipitation concentrations for TP average 15% of bulk deposition values. Weighted-average TP concentrations in bulk precipitation were 0.050 and 0.064 mg/l in the north and south basins, respectively. Atmospheric TP loading was correlated closely to Ca and Mg loading, independent of precipitation amount, and exhibited a large dry fall component. Wind-blown soil and re-entrained dust are believed to be the major source of atmospheric phosphorus addition to Lake Michigan. (Humphreys-ISWS)
W78-09340

CONCENTRATION-DEPENDENT DIFFUSION APPLIED TO GROUNDWATER CONTAMINATION PROBLEMS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Civil Engineering.
P. Basak, and V. V. N. Murty.
Journal of Hydrology, Vol. 37, No. 3/4, p 333-337, May 1978. 4 fig, 3 ref.

Descriptors: *Groundwater, *Water pollution, *Groundwater movement, *Aquifers, Analytical techniques, Theoretical analysis, Mathematical models, Diffusion, Path of pollutants, Porous media, Rates, Concentration-dependent diffusion.

Contamination of groundwater aquifers from stationary sources occurs in several situations. Streams, lakes, drainage channels, waste-water disposal sites or stagnant ponds containing contaminated water and laterally connected to groundwater aquifers cause the spread of the contaminant into adjoining aquifers. Whenever contamination occurs from stationary water bodies, it is likely in some cases that the concentration of a particular contaminant in the source decreases with time owing to artificial or natural recharge with freshwater from external sources. An analytical solution to the problem of concentration-dependent diffusion with decreasing concentration at the source was presented. The solution is nondimensionalized and it can be used to predict the contamination in an aquifer from a source in whch the contamination concentration decreases with time. (Humphreys-ISWS)
W78-09354

ENVIRONMENTAL BEHAVIOR OF ANIONIC AND NONIONIC SURFACTANTS (DAS UMWELTVERHALTEN ANIONISCHER AND NICHTIONISCHER TENSIDE),
Prater and Gamble European Technical Center, Grimbergen (Belgium).
For primary bibliographic entry see Field 5C.
W78-09405

TEHRAN GROUND WATER POLLUTION BY DETERGENTS,
Tehran Univ. (Iran). Dept. of Environmental Health.
For primary bibliographic entry see Field 5A.
W78-09421

ANION MOBILITY IN SOILS: RELEVANCE TO NUTRIENT TRANSPORT FROM TERRESTRIAL TO AQUATIC ECOSYSTEMS,
Washington Univ., Seattle. Coll. of Forest Resources.
D. W. Johnson, and D. W. Cole.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-271 725, Price codes: A03 in paper copy, A01 in microfiche. Report EPA-600/3-77-068, June, 1977. 27 p, 8 fig, 1 tab, 50 ref, 1 append.

Descriptors: *Nutrients, *Soil chemistry, Ions, *Anions, Adsorption, Leaching, Model studies, Water pollution sources, Anion exchange.

Nutrient transport from terrestrial to aquatic ecosystems in strongly mediated by soil chemical interactions. Ions deposited on or biologically released within the soils can enter into a variety of exchange and precipitation reactions prior to (or instead of) entering aquatic ecosystems. Current knowledge of soil anion adsorption reactions and their effects on leaching is reviewed and a simple model, based on anion production and adsorption considerations, to predict and explain nutrient transport is described. The relationship of this approach to that based on cation production and adsorption is discussed. (Skogerboe-Colorado State)
W78-09442

AGRICULTURE RUNOFF MANAGEMENT (ARM) MODEL--VERSION II. REFINEMENT AND TESTING,
Hydrocomp, Inc., Palo Alto, CA.
A. S. Donigian, Jr., D. C. Beyerlein, H. H. Davis, Jr., and N. H. Crawford.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 105, Price codes: A14 in paper copy, A01 in microfiche. Report EPA-600/3-77-098, August, 1977. 294 p, 108 fig, 17 tab, 3 append.

Descriptors: *Watersheds(Basins), Georgia, Michigan, Hydrology, Pesticides, Sediments, Nutrients, Runoff, Water quality, *Model studies, *Watershed management, *Agricultural runoff, *Agricultural watersheds.

The Agricultural Runoff Management (ARM) Model has been refined and tested on small agricultural watersheds in Georgia and Michigan. The ARM Model simulates the hydrologic, sediment production, pesticide, and nutrient processes on the land surface and in the soil profile that determine the quantity and quality of agricultural runoff. The research and model refinements related to soil moisture and temperature simulation, pesticide degradations, nutrient transformations and plant nutrient uptake are discussed. The goal is to evaluate and improve the pesticide and nutrient simulation capabilities of the ARM Model. However, the runoff and sediment modeling is also analyzed since these are the critical transport mechanisms of agricultural chemicals. (Skogerboe-Colorado State)
W78-09444

ASSESSMENT OF IRRIGATION RETURN FLOW MODELS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
W. R. Walker.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 897, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-76-219, October 1976. 75 p, 4 fig, 11 ref. 7 append.

Descriptors: *Return flow, Water quality, *Model studies, Soils, Aquifer systems, Crops, Application methods, *Irrigation, Salinity, Mathematical models, Soil chemistry, Water consumption, Drainage, Leaching, *Evaluation.

Throughout the Western United States irrigation return flows contribute to the problem of water quality degradation. Evaluating the effectiveness of alternative management strategies involves models which simulate the processes encompassed by irrigated agriculture. The development and application of these models require multidisciplinary expertise. A workshop involving 15 specialists in the varied aspects of irrigation return flow modeling was held to review the status of these models. Irrigation return flow and conjunctive use models recently developed by the Bureau of Reclamation served as focal points for the workshop. As the field verification and potential applications of these models were discussed, several general problems were identified where further investigation is needed. Particular emphasis was given to the description of the spatially varied aspects of soil, crop, and aquifer systems, and the proper alignment of model objectives with available data. The large number and diversity of existing models illustrate the individualistic nature of irrigation return flow modeling. In order to effect more widespread utilization of existing models, a systematic procedure should be developed to update and disseminate this modeling technology. (Skogerboe-Colorado State)
W78-09445

EFFECTS OF IRRIGATION METHODS ON GROUNDWATER POLLUTION BY NITRATES AND OTHER SOLUTES,
Texas A and M Univ., Lubbock. Agricultural Research and Extension Center.
C. W. Wendt, A. B. Onken, O. C. Wilke, and R. D. Lacewell.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-268 322, Price codes: A16 in paper copy, A01 in microfiche. Report EPA-600/2-76-291, December 1976. 330 p, 197 fig, 46 tab, 23 ref.

Descriptors: *Irrigation practices, Fertilizers, Nitrogen, Isotopes, *Water pollution, Soil water, *Nitrates, *Irrigation water, *Fertilization.

Sprinkler irrigation, furrow irrigation, subirrigation, automated subirrigation, criteria for applying irrigation water, methods of applying fertilizer and sources of fertilizer were investigated as to their potential to decrease possible pollution from nitrate and other solutes in a loamy fine sand soil overlying a shallow aquifer in Knox County, Texas. Less nitrate-nitrogen was available for leaching in subirrigation systems than furrow and sprinkler systems. Less irrigation water was applied with automated subirrigation systems than with the other irrigation systems. However, crop water requirement was not significantly changed--the soil water was more efficiently used. Fertilizer remained in the root zone if the water applied was based on potential evapotranspiration and leaf area regardless of the irrigation system or the criteria used to apply the irrigation water. Banded fertilizers moved differently in the different irrigation systems. Subirrigation has the possibility of having irrigation return flow with lower concentrations of other solutes than sprinkler or furrow systems. Banding fertilizer in the bed was superior to banding below the level of the water furrow and applications in the irrigation water relative to quality of irrigation return flow. No other source of nitrogen fertilizer was indicated to be superior. Current fertilization practices are not causing major increases in the nitrate-nitrogen level in the aquifer. (Skogerboe-Colorado State)
W78-09446

NITRATE IN EFFLUENTS FROM IRRIGATED LANDS (ANNUAL REPORT),
California Univ., Berkeley.
P. F. Pratt, J. W. Biggar, F. E. Broadbent, D. D. Focht, and L. J. Lund.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 673, Price codes: A05 in paper copy, A01 in microfiche. Report NSF/RA-770308, July 1977. 91 p, 13 fig, 17 tab, 14 ref.

Descriptors: *Nitrates, Nitrification, Chemical reactions, Denitrification, *Irrigated land, Effluents, Irrigation, *Nitrogen, Soil-water-plant relationships, Soil properties, Leaching, Water quality control, Water pollution.

Progress is reported in the development of technologies for measurements of NO3(-) leaching and denitrification and in understanding of the factors that influence the quantities of nitrogen that go into various sinks. Research on various aspects of the nitrogen cycle in the soil-plant-water system are discussed, including: (1) nitrogen transformations with particular emphasis on denitrification; (2) crop utilization of nitrogen; (3) incorporation of nitrogen into and cycling in soil organic matter; (4) fluxes of water through the root zone; and (5) effects of soil profile properties on nitrogen leaching and denitrification. (Skogerboe-Colorado State)
W78-09447

METHODOLOGY FOR CALIBRATING STORMWATER MODELS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
T. K. Jewell, T. J. Nunno, and D. D. Adrian.

Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 104, No. EE3, p 485-501, June 1978. 3 fig, 6 tab, 16 ref. OWRT A-095-MASS(1) and B-059-MASS(1).

Descriptors: *Water quality, *Storm water, *Urban planning, Hydrology, *Computer models, Sewers, Environmental engineering, Regional planning, Water pollution, Management, Biochemical oxygen demand, Computer programs, Hydrologic data, Sensitivity analysis, Maple Brook basin(Greenfield Mass), Equations, Systems analysis, Prediction, Pollutants, Simulation analysis.

In order to deal with the difficulties involved in gathering storm runoff data, an increased emphasis is being placed on the use of computer models for predicting quantity and quality of urban stormwater runoff. Calibration involves minimization of deviations between measured field conditions and model output by adjusting parameters within the model. A method is presented for calibrating coupled quantity-quality stormwater management models; the United States Environmental Protection Agency Storm Water Management Model is used as an example. Quantity and quality subroutines are separated, and each is calibrated using measured data. Data from six storm events are used for quantity calibration and data from five storm events used for quality calibration. Model parameters are adjusted, based on sensitivity analyses, until predicted and measured outputs are within stated calibration criteria. The calibrated models are then recombined and the coupled model is used to predict annual pollutant loadings. Loading rates are compared with loading rates predicted using a single storm event calibrated model. This method provides an accurate and economic tool for predicting alternative futures. (Bell-Cornell)
W78-09459

FIELD STUDY OF THE EFFECTS OF STORMS ON THE STABILITY AND FATE OF DREDGED MATERIAL IN SUBAQUEOUS DISPOSAL AREAS,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
For primary bibliographic entry see Field 5E.
W78-09471

FEASIBILITY OF PINTO ISLAND AS A LONG-TERM DREDGED MATERIAL DISPOSAL SITE,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5E.
W78-09474

AQUATIC DISPOSAL FIELD INVESTIGATION, GALVESTON, TEXAS, OFFSHORE DISPOSAL SITE; APPENDIX B: INVESTIGATION OF WATER-QUALITY PARAMETERS AND PHYSICOCHEMICAL PARAMETERS,
Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.
For primary bibliographic entry see Field 5E.
W78-09483

AQUATIC DISPOSAL FIELD INVESTIGATIONS, EATONS NECK DISPOSAL SITE, LONG ISLAND SOUND; APPENDIX B: WATER-QUALITY PARAMETERS AND PHYSICOCHEMICAL SEDIMENT PARAMETERS.
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5E.
W78-09486

POLLUTION FROM SEVERAL WOOD SPECIES IN HARDBOARD PRODUCTION,
Industrial Environmental Research Lab.- Cincinnati, Corvallis, OR. Food and Wood Products Branch.
V. Dallons.
Forest Products Journal, Vol 28, No 1, p 42-47, January, 1978. 10 fig, 6 ref, 4 tab.

Descriptors: *Pulp wastes, *Water pollution, *Hardboard, Effluents, *Water pollution sources, Wastes, Industrial wastes, Dissolved solids, Suspended solids, Chemical oxygen demand, Biochemical oxygen demand, Hydrogen ion concentration, Pine trees, Softwood, Hardwood, Aspen(Populus), Oak(Quercus alba), Pine(Pinus strobus), Douglas-fir(Pseudotsuga menziesii).

Different species of wood chips (viz., Populus, Quercus alba, Pinus strobus, and Pseudotsuga menziesii) were streamed at various pressures and times, refined in a Bauer refiner, and dewatered. The water samples were analyzed for total, dissolved, and suspended solids; soluble and total COD and BOD; and pH to determine the pollution loadings from hardboard mills. The more severe cooking conditions required to manufacture S2S (smooth 2 sides) hardboard resulted in higher raw waste loadings of soluble BOD and COD than in S1S (smooth 1 side) board production for the same species of wood. The amount of suspended solids in the raw waste load proved to be independent of cooking conditions but highly dependent on the species of wood used. Actual loads from hardboard mills deviate from the experimentally determined BOD and COD raw waste loadings because of process variations such as the amount of white water recycling. A reduction of unnecessarily severe cooking conditions could reduce the raw waste load at some S2S hardboard mills. (Swichtenberg-IPC)
W78-09506

COMPARATIVE MEASUREMENTS OF CHEMICAL OXYGEN DEMAND OF KRAFT PULP MILL EFFLUENTS VIA THE DICHROMATE AND PERMANGANATE METHODS (MEDIDAS COMPARATIVAS DE LA DEMANDA QUIMICA DE OXIGENO AL DICROMATO Y LOS INDICES DE PERMANGANATO. EN EFLUENTES DE FABRICACION DE PASTA KRAFT),
Instituto Nacional de Investigaciones Agrarias, Madrid (Spain).
For primary bibliographic entry see Field 5A.
W78-09507

COMPOSITION OF PULP INDUSTRY EFFLUENTS (COMPOSICION DE LAS AGUAS RESIDUALES DE LA INDUSTRIA DE LA PASTA),
Centro de Investigaciones del Agua, Madrid (Spain).
J. M. Arias Carrillo.
Investigacion y Tecnica del Papel, Vol 14, No 54, p 925-940, October, 1977. 6 tab. English summary.

Descriptors: *Pulp wastes, *Sulfite liquors, *Chemical composition, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Effluents, Water pollution, Chemical wastes, Black liquor, Spent sulfite liquor, Wood, Chemical structure.

After a brief introduction to the chemical structure of the main components of wood, the chemical composition of pulp mill effluents (especially kraft black liquor and spent sulfite liquor) is reviewed along with their polluting capacities. (Speckhard-IPC)
W78-09508

REMOVAL OF METHANOL FROM THE SULPHATE (PULPING) PROCESS,
Rosenlew (Oy. W.) A. B., Pori (Finland).
For primary bibliographic entry see Field 5D.
W78-09510

COMPOSITION OF BEECH MAGNEFITE PULP BLEACHING EFFLUENT (ZLOZENIE ODPADOVYCH VOD Z BIELENIA BUKOVEJ MAGNEFITOVEJ BUNICINY),
Vyskumny Ustav Papieru a Celulozy, Bratislava (Czechoslovakia).
T. Halmova, and L. Balhar.
Vyskumne Prace z Odboru Papiera a Celulozy, Vol. 22, p V37-V40, 1977. 2 ref, 8 tab, English summary.

Descriptors: *Bleaching wastes, *Sulfite pulp mills, Magnesium sulfite, Sulfite liquors, Wastes, Industrial wastes, Pulp wastes, Water pollution sources, Pulp and paper industry, Chemical oxygen demand, Biochemical oxygen demand, Water pollution, Mangefite pulp, Beech trees(Fagus).

The amount of dissolved organic compounds leaving a magnefite pulp mill with the bleachery effluent depends on the unbleached pulp yield and the bleaching process used. Pulp with better than 90% brightness can be obtained with an unbleached pulp kappa number of 18.1-26.4 and a CECEHHH sequence or a sequence utilizing chlorine dioxide. With the CECEHHH sequence, the following pollution load is generated: 54.2-86.49 kg/ton of COD (chromate), 18.79-34.0 kg/ton of COD (Kubel) and 20.68-32.69 kg/ton of 5-day BOD. The pollution loads generated by each stage in the CEH, CEHHH, and CECEHHH bleaching of beech magnefite pulps with a kappa number of 18.1-26.4 are given. (Trubacek-IPC)
W78-09514

DEVELOPMENT OF A MATHEMATICAL WATER QUALITY MODEL FOR GRAYS HARBOR AND THE CHEHALIS RIVER, WASHINGTON.
Battelle Pacific Northwest Lab., Richland, WA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-260 729, Price codes: A04 in paper copy, A01 in microfiche. Prepared for Environmental Protection Agency, Washington, D.C., October 1974. 56 p, 22 fig, 4 tab, 10 ref.

Descriptors: *Water quality, *Model studies, *Simulation analysis, *Hydrodynamics, *Grays Harbor(Wash), *Chehalis River(Wash), Estuaries, Tide flat channels, Biochemical oxygen demand, Dissolved oxygen, Nitrogen, Salinity, Phosphorus, Ammonia, Chlorophyll, Coliform bacteria, Washington.

This report documents the application of a hydrodynamic and water quality model to Grays Harbor and the Chehalis River, Washington. The Battelle-Northwest models (EXPLORE-I (for tidally influenced systems) and PIONEER-I (for nontidal systems) were combined to simulate concentrations of water quality parameters. The EXPLORE-I code was applied to the tidally influenced portions of Grays Harbor and the PIONEER-I code to the Chehalis River. Modifications were made to the EXPLORE-I code for this project and included: conversion to IBM computer, addition of 'tide flat channels,' options to specify quality of incoming seawater, options to use only a subset of model parameters, and conversion to metric units. The model was successfully calibrated and verified for dissolved oxygen in 1970, 1971, and 1972. Waste discharge and water quality data were obtained from extensive surveys supervised by the Washington State Department of Ecology. It was found that the quality of incoming seawater and benthic oxygen demand were extremely important variables affecting water quality in the Harbor and lower Chehalis River. Lack of data precluded calibration and verification of the PIONEER-I model, although it was set up and applied to the Chehalis River. (Bell-Cornell)
W78-09518

SYSTEMS PROGRAM FOR THE ANALYSIS OF NONURBAN, NONPOINT SOURCE POLLUTANTS IN THE MISSOURI BASIN REGION,
Midwest Research Inst., Kansas City, MO.
A. E. Vandegrift, and S-y. Chiu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 602, Price codes: A06 in paper copy, A01 in microfiche. Prepared for Environmental Protection Agency, Office of Water Programs, Denver, Colorado, May 1973. 123 p, 15 fig, 8 tab, 6 append.

Descriptors: *Missouri River, Surface waters, *Environmental effects, *Long-term planning, *Water pollution control, *Data collections, Water policy, Decision making, Watersheds(Basins), Agriculture, Mathematical models, Systems analysis, *Computer programs.

A program for the analysis of nonurban, nonpoint source pollutants in the Missouri River Basin was conducted at Midwest Research Institute under the sponsorship of the Environmental Protection Agency (EPA). The ultimate goal of the program is to develop system models that can be used by EPA to assess the impact of nonpoint source pollutants on the quality of surface water and to facilitate long-range planning for pollution control. The program consists of three phases: Phase I (the work conducted to date) involved efforts to (1) provide physical data in order to establish relationships that can be used to predict and assess water quality problems, establish abatement priorities, and determine effects under various conditions; and (2) provide economic base data that can be used for cost projections, economic analyses, incentive development, and EPA policy determination for the various components of nonpoint source pollution. Phase II and Phase III involve development models, analytical tools and computer programs that EPA can use to implement effective pollution-control programs. This report describes the results accomplished in Phase I of the program. The principal results concern: determination of data needs and data sources; preliminary data evaluation; data compilation; and report organization. Phase I conclusions include: the methodology developed to treat nonurban situations is unique and useful for similar studies; and available data are sufficient for economic projection. (See also W78-09520) (Bell-Cornell)
W78-09519

SYSTEMS PROGRAMS FOR THE ANALYSIS OF NONURBAN, NONPOINT SOURCE POLLUTANTS IN THE MISSOURI BASIN REGION. SUPPLEMENT,
Midwest Research Inst., Kansas City, MO.
A. E. Vandegrift, and S-y. Chiu.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 603, Price codes: A03 in paper copy, A01 in microfiche. Prepared for Environmental Protection Agency, Office of Water Programs, Denver, Colorado, May 1973. 44 p, 1 fig, 4 appen.

Descriptors: *Missouri River, *Water quality control, *Data processing, *Streams, *Environmental effects, Watersheds(Basins), Computer programs, Rural areas, Hydrology, Mathematical models, Systems analysis.

A program for the analysis of nonurban, nonpoint source pollutants in the Missouri River Basin has been conducted at Midwest Research Institute under the sponsorship of the Environmental Protection Agency (EPA). The ultimate goal of the program is to develop system models that can be used by EPA to assess the impact of nonpoint source pollutants on the quality of surface water and to facilitate long-range planning for pollution control. Presented herein is a supplement to the report on Phase I of the program, which involved efforts to (1) provide physical data in order to establish relationships that can be used to predict and assess water quality problems, establish abatement priorities, and determine effects under various conditions; and (2) provide economic base data that can be used for cost projections, econimic analyses, incentive development, and EPA policy determination for the various components of nonpoint source pollution. Data have been collected, evaluated, compiled and organized. This supplement provides a user's manual and computer program listing. (See also W78-09519) (Bell-Cornell)
W78-09520

SYNOPTIC RAINFALL DATA ANALYSIS PROGRAM (SYNOP),
Hydroscience, Inc., Westwood, NJ.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-264 563, Price codes: A06 in paper copy, A01 in microfiche. Prepared for: Municipal Environmental Research Lab., Environmental Protection Agency, Cincinnati, Ohio, July 1976. 115 p, 1 fig, 1 tab.

Descriptors: *Water pollution, *Rainfall, *Storms, *Computer programs, Surface waters, Runoff, Statistical methods, Rainfall records, Storm loadings, Weather bureau, Magnetic tapes, FORTRAN, Effects.

An integral part of the assessment of the effects of storm loads on water quality is the statistical evaluation of rainfall records. Hourly rainfall records of many years' duration are cumbersome and difficult to analyze. The purpose of this rainfall data analysis program is to provide the user with a tool for summarizing and statisticaly characterizing a rainfall record of interest using U.S. Weather Bureau magnetic tapes. Statistical analysis of variables of interest (volume, duration, intensity, and time between storms) are given to determine seasonal trends which are of importance in assessing impacts and selecting control alternatives for storm related loads. This publication is Appendix E of the Final Report. (Bell-Cornell)
W78-09521

SUMMARY REPORT ON THE LONG-TERM WATER QUALITY OF THE SOUTH PLATTE RIVER BASIN 1966-1972,
Environmental Protection Agency, Denver CO. Region VIII.
J. E. Hardaway, and R. L. Fox.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 570, Price codes: A07 in paper copy, A01 in microfiche. Report EPA-908/2-74-002, August 1974. 117 p, 19 fig, 10 tab, 7 append.

Descriptors: *South Platte River(CO), *Water quality, *Water pollution effects, *Coliforms, *Dissolved oxygen, *Biochemical oxygen demand, Rivers, Tributaries, Watersheds(Basins), Denver(CO), Monitoring, Basic data collections, Nutrients, Nitrate, Phosphate, Ammonia.

Analysis of water quality data collected 1968-72 at 21 sampling stations in the South Platte River Basin (Colorado) shows that surface water quality significantly deteriorates as it passes through the Denver metropolitan area. At Denver coliforms and BOD5 levels have increased in recent years, and dissolved oxygen has sometimes dropped below the acceptable limit of five mg/l. A monitoring system is proposed to improve data reliability and comprehensiveness. Highest coliform concentrations were usually at the Franklin Street station, averaging 550,000/100 ml for total coliforms, and 3000/100 ml for fecal coliforms. Levels have occasionally risen to 100 times the mean values. DO content decreased from a median upstream of about eight mg/l to a median of six mg/l at Denver, with lows of two mg/l. BOD5 increased to a median of about 15 mg/l in the metropolitan area, with highs over 25 mg/l. Nitrate, phosphate, and ammonia all showed high levels from Denver as far as 100 km downstream to Kersey. Phosphate and ammonia were particularly high at seven and six mg/l. Overall deterioration of water quality in the main stem occurred throughout the metropolitan area, not just downstream from the major treatment plants. Over the study period there was a general decrease in coliform bacteria, but an increase in recent years in the Denver area. DO has varied in a cyclical but unpredictable fashion. BOD5 have been relatively consistent, except at Henderson which doubled in the first quarter of 1973. (Lynch-Wisconsin)
W78-09531

CLARK FORK RIVER STUDY - MONTANA - JULY, AUGUST, 1973.
Environmental Protection Agency, Denver, CO. Region VIII.
For primary bibliographic entry see Field 5C.
W78-09532

DILLON RESERVOIR - BLUE RIVER STUDY - COLORADO, JUNE, JULY, AUGUST - 1973.
Environmental Protection Agency, Denver, CO. Region VIII.
For primary bibliographic entry see Field 5C.
W78-09533

MICROBIAL TRANSFORMATION OF (14)C-LABELLED 2,4,6-TRINITROTOLUENE IN AN ACTIVATED-SLUDGE SYSTEM,
Army Natick Research and Development Command, MA.
For primary bibliographic entry see Field 5D.
W78-09553

METROPOLITAN WATER SYSTEMS OPERATION: CONTINUOUS MODELING OF FLOW QUANTITY AND QUALITY IN THE SUPPORTING RIVER BASIN,
Dallas Water Utilities Dept. TX. Operations Analysis Div.
For primary bibliographic entry see Field 5C.
W78-09569

HEAVY METALS CONTAINED IN RUNOFF FROM LAND RECEIVING WASTES,
Minnesota Agricultural Experiment Station, St. Paul.
W. E. Larson, and R. H. Dowdy.
In: Disposal of Residues on Land, Proceedings of the National Conference on Disposal of Residues on Land, St. Louis, Missouri, September 13-15, 1976. p 21-26, 3 fig, 5 tab, 16 ref.

Descriptors: *Waste disposal, *Water pollution, Sewage disposal, Sludge disposal, *Heavy metals, Runoff, *Path of pollutants.

Heavy metals were measured in runoff waters and eroded sediments on a sewage sludge treated area. Soils on the area were primarily Typic Hapludolls on up to 10% slopes. The sludge was low in metals and 28.5 mt/ha was applied over a 2 year period. Zn, Cu, Cd, Pb, Ni, and Cr concentrations in the runoff were low with concentration of Zn and Cu being greater in sediment than in waters except during periods of snowmelt or storms. (Chilton-ORNL)
W78-09573

INSECTICIDES, POLYCHLORINATED BIPHENYLS AND METALS IN AFRICAN LAKE ECOSYSTEMS. II. LAKE MCILWAINE, RHODESIA,
South Dakota State Univ., Brookings. Dept. of Chemistry.
Y. A. Greichus, A. Greichus, H. A. Draayer, and B. Marshall.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 4, April, 1978, p 444-453, 1 fig, 3 tab, 21 ref.

Descriptors: Environmental effects, *Water pollution effects, Pollutants, *Pesticide residues, *Insecticides, *Polychlorinated biphenyls, *Metals, Lakes, *Africa.

This paper reports results of concentrations of selected contaminants in one of three African lake ecosystems. Results from Hartbeespoort and Vioelvlei Dams, Republic of South Africa, have been previously reported. Lake McIlwaine is a highly eutrophic lake formed by an earth dam. Insecticide residues most commonly detected were DDT, DDD, DDE and dieldrin. Levels of total insecticides for all types of samples from Lake McIlwaine were higher than those of Voelvlei and lower than those of Hartbeespoort except bottom sediments which had higher levels than either of the others. Generally, PCB's were higher than those of Voelvlei and lower than those of Hartbeespoort. Highest concentrations of metals (except for arsenic and copper) were found in an area near the sewage effluent of Salisbury. Evidence for the accumulation of lead and mercury in food chains was found in cormorant carcasses. (See also W78-09575) (Chilton-ORNL)
W78-09574

INSECTIDES, POLYCHLORINATED BIPHENYLS AND METALS IN AFRICAN LAKE ECOSYSTEMS. III. LAKE NAKURU, KENYA,
South Dakota State Univ., Brookings. Dept. of Chemistry.
Y. A. Greichus, A. Greichus, B. D. Ammann, and J. Hopcraft.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 4, April, 1978, p 454-461, 1 fig, 2 tab, 7 ref.

Descriptors: Environmental effects, *Water pollution sources, Pollutants, *Pesticide residues, *Insecticides, *Polychlorinated biphenyls, *Metals, Lakes, *Africa, *Ecosystems.

This paper presents the results of the last of four studies on concentrations of selected contaminants in African lake ecosystems. The other three lakes involved in these studies were Hartbeespoort and Voelvlei Dams, Republic of South Africa, and Lake McIlwaine, Rhodesia. Lake Nakuru is a closed system with no outlet. In general, levels of arsenic, manganese, lead, zinc and mercury did not appear unusual when compared to these metals in the other three lakes. Levels of cadmium in water, chironomids, aquatic insects, and fish were higher in Lake Nakuru. Bottom sediments from the Nakuru Lake were higher in cadmium than in other portions of the lake. Concentrations of insecticide residues and PCB's in the lake did not appear at present to be a pollution problem. (See also W78-09574) (Chilton-ORNL)
W78-09575

A STUDY OF ESCHERICHIA COLI SURVIVAL IN HIGH LATITUDE WATERS (IN RUSSIAN),
Murmanskii Morskoi Biologicheskii Inst. (USSR).
O. N. Trunova, and N. I. Pilipas.
Gig Sanit (8), p 104-105, 1977.

Descriptors: *Bactericidal activity, *Barents Sea, Contamination, Reservoirs, Russian-SFSR, Sewage, USSR, Water pollution, *E coli, *Self-purification, Sea water, Potable water.

Using E. coli, a comparison was made of the bactericidal activity of sea water from a bay of the Barents Sea (Russian SFSR, USSR) contaminated with commercial and domestic sewage with that of drinking water from a reservoir. Natural sea water had a significantly higher bactercidal activity than fresh water. In tests with natural and inactivated sea water of the presence of biological factors of self-purification, the destruction of E. coli occurred faster than in autoclaved water. Test microbes died more slowly in samples of sea water preserved a low temperature than at 20 degrees C, indicating a retardation of the self-purification processes in conditions of high latitude waters.--Copyright 1978, Biological Abstracts, Inc.
W78-09577

EFFECT OF FERTILIZER ON THE RISE IN NITROGEN CONTENT IN SOURCES OF DRINKING WATER (IN RUSSIAN),
All Union Research Inst. of Tea and Subtropical Plants, Colchis (USSR).
M. K. Daraseliya, T. A. Glonti, and N. S. Babilodze.
Soobshch Akad Nauk Gruz Ssr 85(3), p 685-688, 1977.

Descriptors: Plantation, Tea, Potable water, *Nitrogen, Fertilizers, Water pollution sources, *Path of pollutants, Springs, Water wells.

High concentrations of nitric N, reaching 50 mg/l of water, were discovered in springs and wells located in the area of tea plantations intensively fertilized with N. It is necessary to raise the ratio of N utilization by plants and to select N forms less susceptible to washing out.--Copyright 1978, Biological Abstracts, Inc.
W78-09579

HYGIENIC ASSESSMENT OF THE EFFECTIVENESS OF MEASURES USED FOR PREVENTING CONTAMINATION OF THE TOMI RIVER (IN RUSSIAN),
Nauchno-Issledovatelskii Inst. Gigieny, Moscow (USSR).
For primary bibliographic entry see Field 5G.
W78-09582

TETRACHLOROETHYLENE IN CONTAMINATED GROUND AND DRINKING WATERS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschutz, Zurich (Switzerland).
W. Giger, and E. Molnar-Kubica.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 4, April, 1978, p 475-480, 1 fig, 1 tab, 11 ref.

Descriptors: *Water pollution sources, Path of pollutants, Pollutants, Potable water, *Organic wastes, Organic compounds, *Switzerland, Industrial wastes, Groundwater, *Tetrachloroethylene.

A study is reported at the evaluation of the source of the tetrachloroethylene contamination in the water supply of the town of Dubendorf. It was found that water was supplied to Dubendorf from Lake Zurich and from three wells. One of these wells was found to be contaminated with levels ranging between 500 and 1000 micro g/l tetrachloroethylene. How the solvent reached the aquifer is presently under investigation. This case study points out the fact that the widely used tetrachloroethylene is of particular concern as a potential pollutant of sub-surface waters. (Chilton-ORNL)
W78-09593

METALS IN AN ACID MINE STREAM AND ESTUARY,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
P. Foster, D. T. E. Hunt, and A. W. Morris.
The Science of the Total Environment, Vol. 9, No. 1, January, 1978, p 75-86, 4 fig, 4 tab, 22 ref.

Descriptors: Environmental effects, *Water pollution sources, *Acid mine water, Acid streams, *Copper, *Zinc, *Manganese, Metals, Estuaries, Sediments.

Analysis of water and sediments of an acid mine stream showed that the river water at the mouth has concentrations of zinc, copper and manganese at least two orders of magnitude above normal river water after dilution by non-metalliferous tributaries. Iron is precipitated from the water along the length of the stream. Copper and zinc are lost from solution by adsorption onto hydrated ferric oxide at pH values of 4.5 for copper and 6.0 for zinc. Concentrations of manganese are affected by dilution. Estuarine waters were found to contain high concentrations of copper and zinc. 50% of the znc and 90% of the copper in the sediment is in a potentially mobile form. Only a few organisms are able to survive in the environment. (Chilton-ORNL)
W78-09596

CHARACTERIZATION AND IMPACT OF STORMWATER RUNOFF FROM VARIOUS LAND COVER TYPES,
Wiggins-Rimer and Associates, Durham, NC.
A. E. Rimer, J. A. Nissen, and D. E. Reynolds.
Journal Water Pollution Control Federation, Vol. 50, No. 2, February, 1978, p 252-264, 7 fig, 7 tab.

Descriptors: Environmental effects, *Land use, *Land classification, Water quality, Runoff, *Storm runoff, Water pollution.

The purpose was to relate the major findings of the Pollution Source Analysis (PSA) and to discuss the impact of various types of land cover on the quality of storm water runoff. The primary objective of the PSA was to determine whether nonpoint source pollution problems existed in the study area. Land use types utilized in the sampling program were: low-activity rural, high-activity rural, low-activity residential, high-activity residential, low-activity commercial, high-activity commercial, and urban. The data generated in the sampling program of specific land uses indicated that the level of nonpoint source pollution generally increases impervious area. The only major exception to this trend was the central business district type land use. (Chilton-ORNL)
W78-09598

AN IN SITU DETERMINATION OF THE DISAPPEARANCE OF COLIFORMS IN LAKE MICHIGAN,
Marquette Univ., Milwaukee, WI.
A. E. Zanoni, W. J. Katz, H. H. Carter, and R. C. Whaley.
Journal Water Pollution Control Federation, Vol. 50, No. 2, February, 1978, p 321-330, 4 fig, 2 tab, 21 ref.

Descriptors: Environmental effects, *Water pollution sources, Wastes, Waste dilution, Bacteria, Enteric bacteria, Lakes, Freshwater, *Lake Michigan, *Coliforms, *Path of pollutants.

Six fecal coliform net surveys were conducted in Lake Michigan off the Milwaukee metropolitan area. Beginning at a point when three rivers discharge into the lake, fecal coliform counts dropped significantly with distance into the lake. It was concluded that this reduction in count is the result of both natural die-off and environmental dilution. To establish the die-off kinetics of enteric bacteria while excluding the dilution effect, tests were conducted at the outfall of the Milwaukee South Shore wastewater treatment plant. Total coliform die-off coefficient was estimated to be 8.72 per day. In general, results showed that a relatively rapid disappearance rate of enteric bacteria occurred in deep freshwater. (Chilton-ORNL)
W78-09599

TRACE METAL CONCENTRATIONS IN ESTUARINE SEDIMENTS: MOBILIZATION, MIXING OR PRECIPITATION,
Waterloopkundig Lab., Delft (Netherlands).
W. Salomons, and W. G. Mook.
Netherlands Journal of Sea Research, Vol 11, No 2, p 119-129, November 1977, 3 fig, 3 tab, 15 ref.

Descriptors: *Water pollution sourcer, *Trace elements, Sediments, Deposition, Estuaries, Metals.

A decrease was observed in the trace metal concentrations of bottom sediments in the seaward direction in the estuaries of the rivers Rhine and Ems. It was concluded that this decrease is caused by the mixing of marine (low metal concentrations) and fluvial (high metal concentrations) sediments. Good agreement between the metal concentrations calculated and those observed in the estuarine deposits shows that the mixing process mainly controls the trace metal concentrations. There was no evidence found for mobilization. (Chilton-ORNL)
W78-09601

NITROGEN, CHLORIDE, AND WATER BALANCE WITH IRRIGATED RUSSET BURBANK POTATOES IN A SANDY SOIL,
Wisconsin Univ.-Madison. Dept. of Soil Science.
P. G. Saffigna, D. R. Keeney, and C. B. Tanner.
Agronomy Journal, Vol. 69, No. 2, p 251-257, March-April 1977. 3 fig, 6 tab, 22 ref.

Descriptors: *Nitrogen, *Chlorides, Irrigation, Irrigation effects, *Potatoes, Sands, Sprinkler irrigation, Fertilizers, Fertilization, Groundwater, Wisconsin, Lysimeters, Irrigation efficiency.

Large applications of sprinkler irrigation and N fertilizer have been implicated in causing nitrate contamination of ground water in central Wisconsin. Field and lysimeter experiments were established in 1972 and 1973 on the Plainfield loamy sand to determine the effect of reducing the amount of sprinkler-irrigation and fertilizer N on potato tuber yields and on the field water and N balance. Two main treatments were used. The conventional (CON) treatment received irrigation water and N fertilizer according to current recommendations. The improved (IMP) treatment received less irrigation water than the CON treatment in both years. A satisfactory mass balance of water, N and Cl for potatoes grown in the lysimeters was obtained. Drainage accounted for considerable amounts of water, N, and Cl outputs with nearly all of the remainder going to evapotranspiration and plant uptake. The carefully managed IMP treatment decreased NO3(-)N leaching from 200 to 120 kg N/ha and lowered the overall average NO3(-)N concentration of the leachate from 23 to 16 mg NO3(-)N/liter. However, the additional costs required to effect a small savings in N fertilizer is probably not justified. (Skogerboe-Colorado State)
W78-09652

NEMATICIDE DISTRIBUTION UNDER A DRIP EMITTER,
Georgia Univ., Athens. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W78-09660

STORM WATER MANAGEMENT MODEL DEVELOPED BY CIVIL ENGINEERS.
Water and Pollution Control, Vol. 116, No. 1, p 20, January, 1978.

Descriptors: *Computer programs, *Data collections, *Storm water, *Overflow, *Sewerage, Instrumentation, Measurement, Watersheds(Basins), Waste water treatment, Municipal wastes.

University of Toronto's Department of Civil Engineering has developed a computer program to analyze storm water overflow characteristics under multi-storm conditions. The program model, called RAFFI, simulates the conditions of storm water runoff in a sewer system in one or more watershed areas during one or more storms. The computer model simplifies storm runoff measurement and also expands the capabilities of other programs. The computer analysis has been reduced from the conventional $300-400 for a six hour event to $15-20/computer run for a 6-month record. RAFFI monitors frequency, duration, volume, and pollution parameters of the overflows, including those which reach water bodies during storm runoff. Because the program's model simulates the overall performance of a sewer system during storm conditions, potential solutions to overflow problems are more readily available. The program model can be used in conjunction with more detailed models such as the Water Resources Engineers Model or the Hydrograph Volume Model. (Lisk-FIRL)
W78-09709

SUSCEPTIBILITY OF COASTAL PLAIN AQUIFERS TO CONTAMINATION, FAIRFAX COUNTY, VIRGINIA, A COMPUTER COMPOSITE MAP,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09735

WATER FOR INDUSTRIAL DEVELOPMENT IN GEORGE, HANCOCK, PEARL RIVER, AND STONE COUNTIES, MISSISSIPPI,
Geological Survey, Nashville, TN. Water Resources Div.; and Geological Survey, Jackson, MS. Water Resources Div.
For primary bibliographic entry see Field 6D.
W78-09744

IDENTIFICATION, INDEXING AND EXCHANGE OF DATA ON ENVIRONMENTAL POLLUTANTS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-09749

PREDICTING SOLUTE TRANSPORT IN SUBSURFACE WATERS,
Geological Survey, Menlo Park, CA. Water Resources Div.
J. Rubin.
In: Proceedings of the World Conference, Towards a Plan of Actions for Mankind, Vol 1, Long-Range Mineral Resources and Growth: Pergamon Press, New York, p 267-280, 1977. 2 tab, 42 ref, append.

Descriptors: *Path of pollutants, *Groundwater, *Forecasting, *Analytical techniques, *Waste disposal, Landfills, Injection wells, Solutes, Model studies, Subsurface waters, Reviews, Evaluation.

In connection with problems of mineral-resources utilization and waste-product disposal, considerations of measures like conservation, reuse and recycling will have to include analyses of various supporting and alternative operations. One such analysis will call for assessing the environmental impact of accidental or controlled waste-product incorporation into the subsurface layers of the earth. Assessment of this kind concerns itself largely with the dangers of polluting useable groundwater resources. Among other things, it takes into consideration the possibility of moderating or eliminating such dangers by utilizing the dispersive, pollutant-fixing and pollutant-degrading capabilities of the subsurface zones. The analysis in question requires the capability to predict, as quantitatively as possible, the course of solute transport and the resulting pollutant concentrations in any given subsurface environment. This paper discusses briefly the present status of the techniques for making such predictions. (Woodard-USGS)
W78-09752

SOIL-SALT INTERACTIONS IN RELATION TO SALT CONTROL,
California Univ., Davis. Dept. of Land, Air and Water Resources.
For primary bibliographic entry see Field 5G.
W78-09771

CALLAHAN RESERVOIR: II. INFLOW AND OUTFLOW SUSPENDED SEDIMENT PHOSPHORUS RELATIONSHIPS,
Agricultural Research Service, Oxford, MS. Sedimentation Lab.
For primary bibliographic entry see Field 5G.
W78-09775

A MODEL FOR THE TRANSPORT OF PESTICIDES IN SOIL WITH DIFFUSION-CONTROLLED RATES OF ADSORPTION AND DESORPTION,
Laboratorium voor Insekticide-nonderzoek TNO, Wageningen (Netherlands).
M. Leistra.
Agriculture and Environment, Vol 3, No 4, p 325-335, October, 1977. 5 fig, 1 tab, 13 ref.

Descriptors: Adsorption, *Model studies, Soils, Soil investigations, Rainfall, Simulation analysis, *Pesticides, *Path of pollutants, Diffusion.

The downward movement of a pesticide in soil, caused by different rainfall patterns, was simulated in a computation model. The movement occurred in the mobile region of a hypothetical soil system by convection together with hydrodynamic dispersion, and by diffusion. Lateral transport took place by diffusion into and out of a soil region with a stagnant liquid phase. With 40 mm of rainfall in 2 days, lateral diffusion distances of a few mm or more caused substantial deviation from the concentration-depth relationship for equilibrium adsorption. With 40 mm of rainfall scattered over 20 days, lateral diffusion distances up to a few mm had little effect, but those of about 10 mm or more had a very strong influence. The initial condition near the soil surface was extremely import. When the pesticide was initially present in the mobile region, overall mobility was comparatively great. Mobility was much lower than with instantaeous adsorption and desorption, when the initial condition was equilibrium between the mobile and stagnant regions near the soil surface. (Skogerboe-Colorado State)
W78-09790

FIELD MEASUREMENTS OF AMMONIA VOLATILIZATION FROM SURFACE APPLICATIONS OF AMMONIUM SALTS TO A CALCAREOUS SOIL,
Agricultural Research Service, Temple, TX. Blackland Conservation Research Center.
W. L. Hargrove, D. E. Kissel, and L. B. Fenn.
Agronomy Journal, Vol. 69, No. 3, p 473-476 1977. 1 fig, 2 tab, 16 ref.

Descriptors: Ammonium, *Ammonium salts, Soils, *Soil investigations, *Calcareous soils, Nitrogen, Fertilizers, Fertilization.

Many laboratory experiments have been conducted to study ammonia volatilization from N fertilizers, but few experiments have been conducted under field conditions. The objective of this study was to evaluate ammonia volatilization in the field from ammonium sulfate and ammonium nitrate applied to the surface of a calcareous soil, Houston Black Clay, that belongs to the fine, montmorillonitic, thermic family of Udic Pellusterts. Volatilization was evaluated indirectly by measuring N uptake by Coastal bermudagrass and directly by measuring ammonia at is volatilized. In the field plot study, estimated losses ranged from 3 to 10% of the applied N for ammonium nitrate, from 36 to 45% of the aplied N for pelleted ammonium sulfate, and from 25 to 55% of the applied N for liquid ammonium sulfate at rates of 140 and 280 kg N/ha. (Skogerboe-Colorado State)
W78-09794

INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: NITROAROMATICS,
Syracuse Research Corps., NY. Center for Chemical Hazard Assessment.
P. H. Howard, J. Santdonato, J. Saxenda, J. Malling, and D. Greninger.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 078, Price codes: A99 in paper copy, A01 in microfiche. Environmental Protection Agency, Report EPA 560/2-75-010, June 1976. 60 p. 152 tab, 69 fig, 689 ref.

Descriptors: *Nitrogen compounds, *Environmental effects, Public health, Pesticides, Monitoring, Biological properties, *Reviews, Physical properties, Chemical properties, *Toxicity, Freshwater fish, Bioassay, *Environmental contaminants, *Nitroaromatics, Environmental exposure factors, *Nitrophenols, Nitrotoluenes, Nitroanilines, Toxicity-humans, Toxicity-birds and mammals, Carcinogenicity, Toxicity-plants, Toxicity-fish, Toxicity-microorganisms.

This report considers the large number of chemicals which contain at least one nitro substituent on an aromatic ring. Approximately 250-300 chemicals are listed as commercial nitroaromatic compounds. However, only about 40 compounds are produced or consumed annually in quantities over 500,000 pounds and perhaps another 50-100 compounds exceed 100,000 pounds. Nitroaromatic compounds are used as pesticides, perfumes, explosives, and chemical intermediates. This report focuses on the non-pesticidal nitroaromatics. Because of the large number of compounds considered in this report, comprehensive information on individual compounds could not be developed. However, adequate information is available to provide priorities for further study and research. Production volume, uses, environmental fate, monitoring, and biological effects were considered. In general nitroaromatic compounds appear to be fairly persistent and exhibit either hematologic or metabolic effects at high levels of exposure. Most of the large-volume nitroarmoatics have not been screened for carciongenic, mutagenic, or teratogenic effects. (EIS-Katz)
W78-09795

EFFECTS OF PHOSPHATE MINERALIZATION AND THE PHOSPHATE INDUSTRY ON RADIUM-226 IN GROUND WATER OF CENTRAL FLORIDA,
Office of Radiation Programs, Las Vegas, NV.
For primary bibliographic entry see Field 5G.
W78-09800

5C. Effects Of Pollution

APPLICATION OF AN OIL SPILL VULNERABILITY INDEX TO THE SHORELINE OF LOWER COOK INLET, ALASKA,
South Carolina Univ., Columbia. Dept. of Geology.
For primary bibliographic entry see Field 5B.
W78-09301

ASSESSMENT OF DAMAGE TO FISH LARVAE BY ENTRAINMENT SAMPLING WITH SUBMERSIBLE PUMPS,
Wisconsin Electric Power Co., Milwaukee.
For primary bibliographic entry see Field 8I.
W78-09302

DISINHIBITION CAUSED BY THE MOLLUSCICIDE N-TRITYL MORPHOLINE (FRESCON) IN THE NERVOUS SYSTEM OF A FRESHWATER SNAIL,
Agricultural Research Council, Brighton (England). Unit of Invertebrate Chemistry and Physiology; and Cambridge Univ. (England). Zoological Lab.
Pesticide Biochemistry and Physiology, Vol. 8, p 225-240, 1978. 3 tab, 12 fig, 24 ref.

Descriptors: *Mode of action, Biochemistry, *Pesticides, *Molluscicides, Mollusks, Gastropods, Snails, Biological membranes, Inhibitors, Chloride, Aquatic animals, Animal physiology, Membranes, Electrochemistry, Laboratory tests, Frescon, Nervous system, Nerve synapses, Gradients, Lymnaea, Disinhibition, N-trityl morpholine, Polarization.

When applied to the isolated nervous system of Lymnaea stagnalis, Frescon (Shell Chemicals) produces spontaneous, summated 'bursts' of synaptic potentials, affecting nearly all the cells in synchrony. Experiments with chloride-free salines containing acetate, propionate, sulfate, nitrate, or bromide ions showed that reversal of chloride inhibitory postsynaptic potentials can produce 'bursts' of the same form as those induced by Frescon. The Frescon 'bursts' are preceded by a progressive change in the reversal potential of spontaneous inhibitory postsynaptic potentials, presumably also resulting from a reduction in the chloride gradient across the cell membrane. It is thus proposed that Frescon acts to alter neuronal intracellular chloride levels, giving rise to a state of 'disinhibition' in which the fine balance between excitatory and inhibitory processes is upset. (EIS-Katz)
W78-09303

PRIMER ON LAKES IN WASHINGTON,
Geological Survey, Tacoma, WA. Water Resouces Div.
For primary bibliographic entry see Field 2H.
W78-09307

LIMNOLOGY OF LAGUNA TORTUGUERO, PUERTO RICO,
Geological Survey, Fort Buchanan, PR. Water Resouces Div.
For primary bibliographic entry see Field 2H.
W78-09314

BIODEGRADABILITY TESTING AND ITS RELEVANCE TO ENVIRONMENTAL ACCEPTABILITY,
Unilever Ltd., Port Sunlight (England). Unilever Research Lab.
For primary bibliographic entry see Field 5A.
W78-09402

ENVIRONMENTAL BEHAVIOR OF ANIONIC AND NONIONIC SURFACTANTS (DAS UMWELTVERHALTEN ANIONISCHER AND NICHTIONISCHER TENSIDE),
Prater and Gamble European Technical Center, Grimbergen (Belgium).
N. T. V. de Oude.
Tenside Detergents, Vol. 14, No. 4, p 189-194, July-August, 1977. 7 fig, 6 tab, 14 ref.

Descriptors: *Surfactants, *Detergents, *Testing procedures, Water quality, *Sampling, Streams, Outfall sewers, Discharge(Water), Analytical techniques, Boron, Waste water disposal, Municipal wastes.

The distribution and toxicity of anionic and nonanionic surfactants in a receiving stream were investigated at a Belgian community without sewage treatment facilities. During the first part of 1976, 85 families recorded their use of detergent supplied for household use during the test period. Samples of river water were collected periodically above and at a sewage outfall, and 1 km below the outfall. The samples were chemically and physically analyzed for detergent components concentrations, degradation, and mineralization with die-away tests. The river and waste waters at the three sampling sites were analyzed with an Azure A reactive substance for anionic surfactants, similar to the methylene blue techniques and Cobalt-thiocyanate method for nonionic detergents. Boron concentrations were also recorded as an indicator substance normally not found in the water or wastes. Toxic units calculated from modified toxicity tests in the water ranged from 3.05-6.90 while 44.1-87.5% Azure A reactive substance was found. (Lisk-FIRL)
W78-09405

ISOLATION OF SALMONELLA FROM SEWAGE WITH A NEW PROCEDURE OF ENRICHMENT,
Hellenic Pasteur Inst., Athens (Greece).
For primary bibliographic entry see Field 5A.
W78-09406

THE EFFECTS OF MADISON METROPOLITAN WASTEWATER EFFLUENT ON WATER QUALITY IN BADFISH CREEK, YAHARA AND ROCK RIVERS,
Texas Univ., Dallas.
G. F. Lee.
Transactions of the Wisconsin Academy of Sciences, Arts and Letters, Vol. 65, p 163-179, 1977. 1 tab, 3 fig, 14 ref.

Descriptors: *Discharge lines, *Diversion structures, Rivers, *Water quality, *Sampling, Nutrient removal, Treatment facilities, Trickling filters, Activated sludge, Chlorination, Biochemical oxygen demand, Suspended solids, Dissolved oxygen, Phosphorus, Nitrogen, Ammonia, Nitrates, Nitrites, Algae, Waste water treatment, Waste water disposal, Municipal wastes.

The impact of diverting the flow of treated effluent from the Madison Metropolitan Sewerage District's Nine Springs Sewage Treatment Plant in Wisconsin to the Badfish Creek was examined. A $3.5 million pipeline was constructed to divert effluent flows to Badfish Creek rather than the Yahara and Rock Rivers, which flow into Lakes Waubesa and Kegonsa where excessive amounts of algae were growing. Activated sludge, trickling filters, and chlorination are employed by the plant before effluent is discharged to the diversion ditch leading to the creek. Flows measured over the period from 1952-1970 ranged from a low of 16.2 mgd in 1953 to a high of 31.3 mgd in 1970; BOD ranged 16-47 mg/liter and suspended solids ranged 15-52 mg/liter. The higher pollutant concentrations occurred during 1961-1963 when the treatment facility was undergoing construction. Water samples from 12 stations on the Badfish Creek and the Yahara and Rock Rivers were analyzed for BOD, suspended solids, total and soluble P, nitrates, nitrites, ammonium, and organic nitrogen. Inorganic nitrogen and orthophosphate concentrations in the Yahara River just below the point where Badfish Creek enters have increased since effluent has been diverted. Nutrient levels in the Rock River below the Yahara River junction have also increased. This increase in orthophosphate has been partially attributed to increased loads of phosphorus on the treatment plant. Dissolved oxygen levels at the first sampling station on Badfish Creek often dropped below 3 mg/liter; dissolved oxygen levels at stations on the lower Yahara River were usually above the critical level. (Lisk-FIRL)
W78-09422

GROWTH AND METAL UPTAKE ON SNAP BEANS GROWN ON SEWAGE SLUDGE-AMENDED SOIL: A FOUR-YEAR STUDY,
Agricultural Research Service, St. Paul, MN.
For primary bibliographic entry see Field 5E.
W78-09439

ASSESSMENT AND SIGNIFICANCE OF SEDIMENT-ASSOCIATED OIL AND GREASE IN AQUATIC ENVIRONMENTS,
Naval Biosciences Lab., Oakland, CA.
For primary bibliographic entry see Field 5E.
W78-09468

AQUATIC DISPOSAL FIELD INVESTIGATIONS, DUWAMISH WATERWAY DISPOSAL SITE, PUGET SOUND, WASHINGTON; APPENDIX C: EFFECTS OF DREDGED MATERIAL DISPOSAL ON THE CONCENTRATION OF MERCURY AND CHROMIUM IN SEVERAL SPECIES OF MARINE ANIMALS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
For primary bibliographic entry see Field 5E.
W78-09485

AQUATIC DISPOSAL FIELD INVESTIGATIONS, EATONS NECK DISPOSAL SITE, LONG ISLAND SOUND; APPENDIX C: PREDISPOSAL BASELINE CONDITIONS OF BENTHIC ASSEMBLAGES,
New York Ocean Science Lab., Montauk.
For primary bibliographic entry see Field 5E.
W78-09487

SUSCEPTIBILITY OF THREE FAMILIES OF FRESHWATER FISH TO DIELDRIN (IN SPANISH),
For primary bibliographic entry see Field 5A.
W78-09491

SYNOPTIC RAINFALL DATA ANALYSIS PROGRAM (SYNOP),
Hydroscience, Inc., Westwood, NJ.
For primary bibliographic entry see Field 5B.
W78-09521

THE PHASED DIVISION OF THE FRESHWATER DINOFLAGELLATE CERATIUM HIRUNDINELLA: ITS USE AS A METHOD OF ASSESSING GROWTH IN NATURAL POPULATIONS,
Freshwater Biological Association, Windemere (England).
M. D. Heller.
Freshwater Biology, Vol. 7, No. 6, p 527-533, 1977. 3 fig, 1 tab, 18 ref.

Descriptors: *Diurnal, *Dinoflagellates, *Ceratium hirundinella, *Plant growth, *Cell division, *Esthwaite water(England), Biorhythms, Phased division, Synchronized division, Phytoplankton, Algae, England, Cytological studies, Lakes, Eutrophication, Methodology, Analytical techniques.

Overnight phasing of cell division by the dinoflagellate Ceratium hirundinella was investigated in 1974-75 in Esthwaite River, a productive lake of the English Lake District, where it often dominates the summer phytoplankton. Counts from samples were made of complete Ceratium, cells, in the process of division, and fronts and backs of divided cells. About 2000-3000 complete cells were counted from each sample. Maximum proportion of Ceratium cells found dividing at any time was 5.8 + or - 1%, and the time of optimum division was 03.00 G.M.T. The daily rate of division during the main phase of population increases was similar to the rate deduced from overall population increments. The proportion of algal cells in a population dividing per day can be used as a method of assessing the population growth rate independently of the observed increase in cell density. Phased cell division facilitates both sampling and conversion to a growth rate or doubling time. Phased or partially synchronized division of C. Hirundinella in Esthwaite Water occurred during a similar number of hours (8-10) of the night and early morning as found for this and other species of Ceratium in other studies. Calculation of growth rates from nocturnal division rates is complicated by: (1) night-to-night variation in division rates, and (2) possible depth-differentiation of different division stages. (Lynch-Wisconsin)
W78-09530

SUMMARY REPORT ON THE LONG-TERM WATER QUALITY OF THE SOUTH PLATTE RIVER BASIN 1966-1972,
Environmental Protection Agency, Denver CO. Region VIII.
For primary bibliographic entry see Field 5B.
W78-09531

CLARK FORK RIVER STUDY - MONTANA - JULY, AUGUST, 1973.
Environmental Protection Agency, Denver, CO. Region VIII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-225 580, Price codes: A02 in paper copy, A01 in microfiche. Report EPA-908/2-74-001, January 1974. 25 p, 10 fig, 2 tab, 2 append.

Descriptors: *Pulp wastes, *Clark Fork River(MT), *Bioindicators, *Water pollution effects, *Hoerner Waldorf Corporation, Pulp and paper industry, Sewage treatment, Meat packing industry, Rivers, Biochemical oxygen demand, Dissolved oxygen, Benthic fauna, Invertebrates, Conductivity, Coliforms, Missoula(MT).

A water quality and biological study was conducted July-August 1973 on the 79-km stretch of the Clark Fork River (Montana) between Missoula and Alberton to assess effects of seepage or surface discharges from the Hoerner Waldorf Corporation paper mill, located west of Missoula. The study, showed no effects on dissolved oxygen or biochemical oxygen demand, but slight conductivity and color increases were evident throughout the study area. Effects on the benthic invertebrate community were greater from discharges of the Missoula Wastewater Treatment Plant and the Dailey Meat Packing Plant than from Hoerner Waldorf pond seepage. DO was above the 7.0 mg/l minimum; total coliforms did not exceed the 1000/100 ml limit, with highest density monitored downstream from the treatment and packing plants, (664/100 ml), and mean fecal coliforms were less than 100/100 ml at all sites, except at the station downstream from the treatment and packing plants (144/100 ml). Below the Hoerner Waldorf ponds, color increased by five units to about 10 units. The biological study indicated this reach of the river was of good quality. Pollution-sensitive stoneflies and mayflies were present at all sampling stations. Upstream of the STP and Hoerner Waldorf discharges none of organisms were pollution tolerant, compared with 70-76% downstream; however recovery was noted 10-23 km further downstream. (Lynch-Wisconsin)
W78-09532

DILLON RESERVOIR - BLUE RIVER STUDY - COLORADO, JUNE, JULY, AUGUST - 1973.
Environmental Protection Agency, Denver, CO. Region VIII.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-255 571, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-908/2-74-002, January 1974, 35 p, 11 fig, 10 tab, 8 ref, 3 append.

Descriptors: *Dillon Reservoir(CO), *Blue River(CO), *Phytoplankton, *Nutrients, *Trophic level, Ten Mile Creek(CO), Phosphorus, Nitrogen, Molybdenum, Water pollution effects, Algae, Eutrophication, Oligotrophy, Reservoirs, Organic loading, Tributaries, Waste water treatment, Bioassay, Basic data collections, Limiting factors, Algal growth potential, Toxicity, Rivers, Watershed(Basins).

A study of existing nutrient levels in Dillon Reservoir (Colorado), and organic and nutrient contributions from major tributaries and wastewater treatment plants during summer 1973, showed that nitrogen concentrations were significant but not excessive and phosphorus levels were not less than 0.05 mg/l except at the outlets of the Blue River Arm and Dillon Bay. Phytoplankton growth indicated the reservoir is gradually changing from oligotrophy to a more enriched state; diatom bloom was observed in July. Algal assays on water from three reservoir locations indicated phosphorus limitation. High molybdenum levels, resulting from mining in the Ten Mile Creek watershed, were found at all cross-sections of the reservoir (mean -351 micrograms/l), especially at the outlet of Ten Mile Creek Arm. Highest concentrations were found near the bottom. Irrigation of forage crops with water from Ten Mile Creek or Dillon Reservoir could have toxic effects on livestock. Molybdenum algal assay showed existing concentrations in the reservoir have no effect on algal growth, however. Greatest tributary organic and phosphorus loading to the reservoir was in June from the Blue River--2368 kg BOD5/day and 45 kg P/day. Three sewage treatment plants discharge effluents directly to the reservoir (Frisco, East Dillon, and Summit County No. 1), Breckenridge STP discharges to the Blue River, and Copper Mountain STP discharges to Ten Mile Creek. Dillon Reservoir provides part of Denver's water supply. (Lynch-Wisconsin)
W78-09533

POWELL RIVER: MORE AND BETTER WATER,
B. C. Research Ltd, Vancouver.
A. E. Birkbeck, and C. Bowden.
Water and Pollution Control, Vol. 113, No. 12, p 28-30, December 1975. 2 fig, 3 tab, 6 ref.

Descriptors: *Powell River(British Columbia Canada), *Hammil Lake(British Columbia Canada), *Water supply, *Potable water, *Odor-producing algae, *Eutrophication, *Flow augmentation, Odor, Canada, Lakes, West Lake(British Columbia Canada), Thermal stratification, Algae, Cyclotella, Diatoms, Chlorella, Succession, Trophic level, Oligotrophy.

Means investigated for augmenting the drinking water supply to communities in the District of Powell River (British Columbia, Canada) by means of a larger abstraction pipe from Hammil Lake (also known as West Lake), while eliminating recurring taste and odor problems. Taste-producing algae were found only above the 60-ft depth, indicating that the water intake should be relocated at that depth where cold water is available throughout the year. Other recommendations: (1) Water should be abstracted at least 15 ft above the lake bottom to avoid drawing benthic sludge into the system; (2) Pressure reduction and subsequent dissolution of air from supersaturated waters should be controlled to prevent corrosion of pipework and air locks in flow measurement equipment; (3) Sediment removal equipment will not be required. Hammil Lake, about one-half mile wide by one mile long, is located in a densely forested area. Results of the study, initiated in 1972, show that the lake thermally stratified and was stable during the summer, clarity was excellent, water chemistry was satisfactory, and turbidity, organic carbon, hardness and metal contaminants were all low. However, nutrient concentrations were at levels capable of supporting algal blooms. A bloom of taste-producing algae forms between the surface and the hypolimnion during the summer. The most abundant algal genus was the diatom Cyclotella, followed by the chlorophyte Chlorella. (Lynch-Wisconsin)
W78-09534

CALCIUM AND CATION SORPTION BY CLADOPHORA FROM THE GREAT LAKES,
Wisconsin Univ., Milwaukee. Center for Great Lakes Studies.

S. Sikes.
Journal of Great Lakes Research, Vol. 3, No. 1-2, p 100-105, October 1977. 5 fig, 1 tab, 20 ref.

Descriptors: *Calcium, *Cations, *Cladophora glomerata, *Sorption, *Strontium, *Eutrophication, Ions, Algae, Chlorophyta, Nutrients, Hydrogen ion concentration, Turbulence, Wisconsin, Lakes, *Great Lakes, Regression analysis, Concentration, Ion exchange, Adsorption, Cation adsorption.

A study of calcium sorption, to evaluate usefulness of the filamentous green alga Cladophora glomerata as a scavenger of exotic cations, showed that total calcium uptake was directly proportional to calcium concentration at low levels (2-20 mg Ca/l), but became saturated at high levels (13 mg Ca/g at 20-100 mg Ca/l). This uptake was largely an ion-exchange reaction, favoring polyvalent cations of small hydrated radius. Cladophora for these batch culture experiments was isolated from the Milwaukee breakwall in Lake Michigan. Effects of concentration, pH, and turbulence were studied and the influence of calcium sorption on that of another ion was assessed by comparing calcium and strontium uptake by Cladophora. Strontium uptake was similar to that of calcium, but Cladophora preferentially adsorbed strontium over calcium by a factor of 1.25. Because exotic cations bound to Cladophora could largely be lost through ion-exchange and dilution in the absence of their source, such accumulations may not be as important as previously thought. Calcium and strontium sorption data for Cladophora from each of the Great Lakes and some inland Wisconsin sites were subjected to analysis of variance; all specimens showed the same cationic sorptive capacity. Turbulence contributed to the variability of calcium sorption through affecting calcium diffusion gradients and pH through affecting calcium solubility of calcium. (Lynch-Wisconsin)
W78-09535

MACROPHYTES OF THE DAM RESERVOIR AT GOCZALKOWICE,
Polish Academy of Sciences, Pszczyna. Hydrobiological Station; Polish Academy of Sciences, Pszcyna. Hydrobiological Station.
T. Kuflikowski.
Acta Hydrobiologica, Vol. 19, No. 2, p 145-155, 1977. 5 fig, 4 ref.

Descriptors: *Goczalkowice Reservoir(Poland), *Eutrophication, *Aquatic weeds, *Macrophytes, *Water level fluctuations, *Water pollution effects, Reservoirs, Nutrients, Phosphorus, Nitrogen, Submerged plants, Potamogeton crispus, Potamogeton perfoliatus, Potamogeton pectinatus, Potamogeton lucens, Polygonium amphibium, Myriophyllum spicatum, Drawdown, Depth, *Poland.

Overgrowth of Goczalkowice Reservoir, Poland by submersed macrophytes during 1973-75, after an earlier period of stabilization (1959-65) and a period of periodic plant die-off (1966-72), seems to result from very high and stable average water level and increased nitrogen and phosphorus levels. Considerable water level fluctuations occurred 1970-72, and this, with the absence of a proper littoral zone, resulted in relatively low macrophyte overgrowth. In 1956-59 vegetative cover experienced high growth, followed by stability in 1959-65. In 1966 Rorippa amphibia suddenly appeared, covering about one ha of the large reservoir, but disappeared in 1967 and has not been observed since. Lowering of the water level by only one m from the average of 245.5 m above sea level uncovers about 500 ha of the bottom, killing all plants. In addition, submersed plants which emerge more than half their height above the water surface are killed as well, as noted during drawdowns in 1965 and 1972 for repair of bottom outlets. The 1972 drawdown lowered the water level to 253 m and uncovered about 800 ha of the bottom. Most plants died, except for those in the deepest areas and a belt of land and littoral vegetation. In 1970-75 submersed species which increased and achieved dominance included Potamogeton crispus, P. perfoliatus, P. pectinatus, Polygonum amphibium, and Myriophyllum spicatum, while Potamogeton lucens, dominant up to 1974, decreased. (Lynch-Wisconsin)
W78-09536

QUANTITATIVE AND QUALITATIVE COMPOSITION OF BOTTOM FAUNA IN POLLUTED PARTS OF LAKE VANERN AND SOME ASPECTS ON WATER QUALITY INDICES,
Statens Naturvardsverk, Stockholm (Sweden). Undersoknings Lab.
B. Nagell, C. C. Landahl, and H. Lann.
Vatten, Vol 4, p 434-441, 1977. 2 fig, 2 tab, 18 ref.

Descriptors: *Lake Vanern(Sweden), *Benthic fauna, *Water quality indices, *Water pollution effects, *Bioindicators, *Chironomidae, *Oligochaetes, Larvae, Midges, Worms, Lakes, Oligotrophy, Species composition, Species diversity, Diversity indices, Distribution, Faunal Lists.

Chironomids and oligochaetes in the benthic fauna of five bays of Lake Vanern, Sweden, are analyzed using data collected in February and March 1971, and the use of species diversity indices for assessing water quality is discussed. Lake Vanern, the largest in Scandinavia with an area of 5600 sq km and a maximum depth of 106 m, supplies water, commercial fishing, and recreational. While the five bays are moderately to severely polluted, the lake is as a whole oligotrophic. The bays studied were Byviken, Barofjarden, Kattfjorden, Saterholmsfjarden, and Asfjorden. Results are presented tables, and a comparison of percent similarity of oligochaetes/chironomids is figured. Spatial distribution was mainly widespread for seven species and intermittent for one. Among chironomids, Procladius spp. and Monodiamesa bathyphila were distributed in areas widely differing in water quality. The three most pollution-resistant oligochaetes had a wide distribution. The main purpose of the study was to describe bottom fauna composition quantitatively for improved statistical comparison with future results. Benthic fauna, especially chironomid midge larvae and oligochaete worms, have proven useful for water quality assessment because: (1) most species are practically stationary, (2) many species have well-defined environmental requirements, and (3) most species live on the bottom for nearly a year. (Lynch-Wisconsin)
W78-09537

PHOSPHATE AND SILICATE KINETICS FOR THE LAKE MICHIGAN DIATOM DIATOMA ELONGATUM,
Michigan Univ., Ann Arbor. Div. of Biological Sciences.
S. S. Kilham, C. L. Kott, and D. Tilman.
Journal of Great Lakes Research, Vol. 3, No. 1-2, October 1977, p 93-99. 5 fig, 1 tab, 35 ref. NSF GB-41315 and OCE 76-10183.

Descriptors: *Diatoma elongatum, *Lake Michigan, *Phosphates, *Silicates, *Kinetics, *Diatoms, Algae, Phytoplankton, Succession, Species composition, Nutrients, Eutrophication, Lakes, Absorption, Plant growth, Limiting factors, Silicon, Phosphorus.

Growth and uptake responses by a clone of the Lake Michigan diatom Diatoma elongatum to limiting concentrations of silicate and phosphate under batch and semi-continuous conditions were investigated. Kinetic data reported here are thought to be the first for a diatom isolated from the Great Lakes. Under phosphate-limited batch growth conditions the half-saturation constant for growth (K) was 0.02 microM phosphate-phosphorus and the maximum growth rate (mu sub m) was 0.7 doublings/day; under silicate-limited conditions, K was 1.51 microM silicon dioxide-silicon, and mu sub m was 1.2 doublings/day. Results from these direct measurements of growth under nutrient limitation agree well with steady state kinetic information obtained for a two-step (uptake and utilization) growth model. Batch uptake experiments and steady state growth experiments provided kinetic information used to estimate the calculated half-saturation constant for growth. K was 0.03 microM phosphate-phosphorus under phosphate limitation, and 1.18 microM silicon dioxide-silicon under silicate limitation. A dependence of the coefficient of luxury on the steady state growth rate was observed. D. elongatum can store up to 28 times more phosphate than needed, and up to 4.4 times more silicate. As more data become available it should be possible to evaluate the importance of nutrient competition among algae as a factor in determining species composition and seasonal succession of lake phytoplankton. (Lynch-Wisconsin)
W78-09538

PHYSICO-CHEMICAL SURVEILLANCE DATA OBTAINED FOR LAKE ONTARIO, 1974 AND THEIR RELATIONSHIP TO CHLOROPHYLL A,
Canada Centre for Inland Waters, Burlington (Ontario).
R. E. Kwiatkowski, and A. H. El-Shaarawi.
Journal of Great Lakes Research, Vol. 3, No. 1-2, p 132-143, 1977. 3 fig, 6 tab, 21 ref.

Descriptors: *Chlorophyll, *Lake Ontario, *Phytoplankton, *Indicators, *Particulate organic carbon, *Total particulate nitrogen, *Eutrophication, Great Lakes, Pheopigments, Carbon, Nitrogen, Secchi disks, Transparency, Water temperature, Lakes, Algae, Biomass, Equations, Regression analysis, Monitoring, Seasonal.

Physical-chemical data from 15 cruises on Lake Ontario in April-November 1974 were used to: (1) describe the spatial and temporal distribution of chlorophyll-a; (2) find the statistical relationship between chlorophyll-a and sounding depth, Secchi depth, transmissivity, temperature, integrated particulate organic carbon (POC), and total particulate nitrogen (TPN); (3) assess the stability of such relationships over time; and (4) represent the data with an autoregressive scheme. Significant correlations were found between chlorophyll-a and the other parameters, and first-order autoregressive equations were established for all measured parameters. Multiple-regression analyses showed that for chlorophyll-a, the physico-chemical parameters explained 74% of spring variability, 49% of summer variability, and 78% of fall variability. The parameters showed certain seasonal patterns; (1) Secchi disk and transmissometer indicated a decreasing pattern until mid-August, then an increase; (2) POC and TPN mean values increased rapidly to a mid-June maximum; (3) temperature means increased rapidly until August, then rapidly decreased; (4) mean sounding depth remained constant throughout the study; and (5) chlorophyll-a was bimodal with spring and fall peaks. The biomass indicators POC and TPN correlated significantly (P is greater than 0.025) with chlorophyll-a in 11 of the 15 multiple regression equations. (Lynch-Wisconsin)
W78-09539

BIOASSAY STUDIES ON THE TOXICITY OF FISH OF DISTILLERY EFFLUENTS,
Punjab Agricultural Univ., Ludhiana (India). Dept. of Zoology-Entomology.
H. S. Gill, and H. S. Toor.
Acta Hydrobiologica, Vol. 18, No. 3, p 229-234, 1976. 2 tab, 11 ref.

Descriptors: *Toxicity, *Fish, *Effluents, *Distilleries, *Lethal limit, *Bioassay, Carp, Cyprinus carpio, Water pollution effects, Profit analysis, Pollutants, Water pollution control, Water quality indexes, Jagatijit Distilleries(Hamira Kapurthala India).

Carp, Cyprinus carpio, were used to test lethal effects of wastewater from Jagatjit Distilleries, Hamira, Kapurthala, India. Concentrations of 5%, 10%, 20%, 35%, 45%, 60%, and 100% plus a control were tested, with 10 fish measuring 3-5 cm in each test. Temperature was maintained at about 30C. Mortality was monitored at 24, 48, 72, and 96 hours. In the control and concentrations of 5% and 10%, no fish died. In 20% concentration, 40% died after 24 hours, and 90% after 96 hours. In 35% concentration, 70% died in 24 hours, and 100% in 96 hours. In 45% concentration, 90% mortality occurred within 24 hours, and the remaining fish died in 72 hours. At 60 and 100% concentrations, all fish died within 24 hours. At 60 and 100% concentrations, all fish died within 24 hours. With increasing concentrations pH decreased, from 7.85 in the control to 6.20 in undiluted effluent. Conductivity, nitrates, and phosphates increased. Five-day biochemical oxygen demand of the effluent was very high (7,700 mg/l). Median Tolerance Limit (TLm), the concentration at which 50% of test animals are able to survive, was calculated at 23.9% for 24 hours, and 17.66% for 48 hours. The safe concentration, below which there are no adverse sublethal or chronic effects on the fish, is estimated at 2.91%; effluents from the distillery should be diluted below this level. Behavioral reactions of the fish to the various concentrations are described. (Lynch-Wisconsin)
W78-09544

OLIGOCHAETES (OLIGOCHAETA) OF SOME STREAMS OF THE HIGH TATRA MTS AND THE RIVER BIALKA TATRZANSKA,
Polish Academy of Sciences, Krakow. Zaklad Biologii Wod.
E. Dumnicka.
Acta Hydrobiologica, Vol. 18, No. 3, p 305-315, 1976. 4 fig, 2 tab, 14 ref.

Descriptors: *Oligochaetes, *Water pollution effects, *Bialka Tatrzanska River(Poland), *Tatra Mountains(Poland), *Rybi Potok River(Poland), Streams, Rivers, Mountains, Annelids, Aquatic animals, Systematics.

Twenty-five species of Oligochaeta of Tatra Mountain streams and rivers in Poland were identified, 12 of them new for that region. Changes in the oligochaetes, apparently caused by water pollution, were found in one stream. Material was collected in the Sucha Woda stream, Bialka and tributaries (Rybi Potok and Toztoka), and the Przelecz pod Chlopkiem Pass stream between 1962-72. Oligochaeta occurred primarily on sandy substrata in lentic areas, and constituted 1-18% of the macrofauna. A total of 4, 341 specimens of 25 species (four families) were collected. Ten species of the family Naididae were identified, eleven of Enchytracida, three of Lumbriculidae, and one of Haplotaxidae. No species of Tubificidae were found. Species of Enchytracidae range from 44.5% to 100% of the oligochaeta in the streams. Between 1963 and 1971 great changes in the oligochaete fauna of Rybi Potok occurred, due to increased sewage pollution from the Morskie Oko mountain shelter. Whereas in 1962-63 enchytracids made up 50% of oligolchaeta, by 1971-72 none were found. Haplotaxis gordiodes likewise disappeared, while new species of Naididae made their appearance. In spite of these indications of increasing pollution, it is likely that in 1962-63 pollution effects were already being felt, as evidenced by its similarity to the Bialka; the Rybi Potok can be viewed as typical of an intermediate stage between clean montane stream and submontane river. (Lynch-Wisconsin)
W78-09546

REPORT OF THE DANE COUNTY ADVISORY COUNCIL FOR LAKE QUALITY IMPROVEMENT, A FRAMEWORK FOR LAKE MANAGEMENT.
Wisconsin Lake Quality Improvement Advisory Council, Madison.
University of Wisconsin Water Resources Management Program, Madison, September 1975. 7 fig, 59 tab.

Descriptors: Dane County(WI), *Lake Mendota(WI), *Lake Monona(WI), *Eutrophication, *Water management(Applied), *Methodology, Madison(WI), Wisconsin, Lakes, Urban runoff, Agricultural runoff, Shore protection, Wetlands, Aquatic weed control, Harvesting of algae, Algae, Algal control, Institutions, Administration, Information exchange, Public relations, Social participation.

Recommendations for management of eutrophic Lake Mendota and Monona (Madison, Wisconsin) are presented by the Dane County Advisory Council for Lake Quality Improvement, formed pursuant to resolution of the County Board in February 1975. The Council, composed of 27 representatives of local governmental and citizen interest groups, with technical assistance from the University of Wisconsin Water Resources Management Program, was created to develop a multi-jurisdictional program for water quality improvement. Goals were to: (1) integrate existing data on lake problems and causes; (2) list lake protection and rehabilitation measures; (3) evaluate these measures in terms of practicality, cost, and compatibility with community goals; and (4) select the most feasible alternatives and prepare an implementation plan which designates administrative and jurisdictional responsibilities. Six study subcommittees were established in the summer of 1975: (1) urban runoff control, (2) rural runoff control, (3) in-lake management, (4) wetlands and shoreline protection, (5) lake management institutions and jurisdiction, and (6) information and communication needs. The report contains an overview of current lake status, recommendations of the subcommittees, and reports from each subcommittee. Recommendations cover such measures as control of leaves and grass debris, street-cleaning, rainwater dispersion, aerial photography, weed harvesting, and farm conservation. (Lynch-Wisconsin)
W78-09552

RESPIRATORY INHIBITION OF ACTIVATED SLUDGE BY DYES (SENRYO NI YORU KASSEIODEI NO KOKYUSOGAI),
Gifu Univ. (Japan). Dept. of Engineering.
For primary bibliographic entry see Field 5D.
W78-09567

METROPOLITAN WATER SYSTEMS OPERATION: CONTINUOUS MODELING OF FLOW QUANTITY AND QUALITY IN THE SUPPORTING RIVER BASIN,
Dallas Water Utilities Dept. TX. Operations Analysis Div.
L. D. Brown.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 131, Price codes: A23 in paper copy, A01 in microfiche. Completion Report, March 1978. 512 p, 1 fig, 1 tab, 12 ref, 1 append. (separately bound). OWRT C-5054(4200(1).

Descriptors: *Water quaity, *Hydraulic models, Rivers, *Unsteady flow, *Oxygen demand, Municipal wastes, Texas, Biochemical oxygen demand, Algae, Temperature, Open channel flow, Nutrients, Coliforms, *Dallas(Tex), *Trinity River(Tex), *Model studies, Cities, *Forecasting.

A dynamic river model was prepared to predict water quality in the upper Trinity River near the Dallas, Texas metropolitan area. Dissolved oxygen simulation considered the effects of biochemical oxygen demand (carbonaceous and nitrogenous), benthic oxygen demand, reaeration, algal respiration and photosynthesis, zooplankton respiration, and temperature. Other water quality attributes simulated were suspended solids, coliform bacteria, bacterial viruses, sodium and chloride, and nitrogen and phosphorus concentrations. Model input data included waste water treatment plant effluent hourly flow rates and quality related concentrations, headwater and tributary inflows, river channel descriptive parameters, and climatological data including wind speed, air temperature, wet bulb temperature, and cloud cover. The model employed a new method for reducing numerical dispersion error. Calibration was aided by a continuous dissolved oxygen monitor in the river which showed the diurnal oxygen variation. The program was written in the PL/I computer language.
W78-09569

A PRELIMINARY ASSESSMENT OF THE EFFECTS OF SUBSURFACE SEWAGE SLUDGE DISPOSAL ON GROUNDWATER QUALITY,
Environmental Protection Agency, Washington, DC. Office of Solid Waste Management Program.
D. C. Mosher.
In: Disposal of Residues on Land, Proceedings of the National Conference on Disposal of Residues on Land, St. Louis, Missouri, September 13-15, 1976 p. 185-188, 3 fig, 4 tab, 3 ref, 68-01-3108.

Descriptors: Environmental effects, *Waste disposal, Sewage disposal, Sludge disposal, Water quality, Heavy metals, Groundwater, *Water pollution effects, *Sewage sludge.

This project attempts to determine differences in groundwater contamination resulting from subsurface sewage sludge disposal (burial of sewage sludge with or without municipal solid waste in trenches, pits or area type landfills) at eight land disposal sites. Data from this study and other studies of solid wastes only show contamination of groundwater has occurred at all sites. Unlike solid waste only sites, the subsurface sewage sludge sites showed a definite trend toward contamination of groundwater with heavy metals. It was concluded that the limited scope of this study does not justify abandonment of subsurface sewage sludge disposal but that it does justify greater emphasis in groundwater resource evaluation for sites which will accept sewage sludge. (ORNL-Chilton)
W78-09572

INSECTICIDES, POLYCHLORINATED BIPHENYLS AND METALS IN AFRICAN LAKE ECOSYSTEMS. II. LAKE MCILWAINE, RHODESIA,
South Dakota State Univ., Brookings. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W78-09574

INSECTIDES, POLYCHLORINATED BIPHENYLS AND METALS IN AFRICAN LAKE ECOSYSTEMS. III. LAKE NAKURU, KENYA,
South Dakota State Univ., Brookings. Dept. of Chemistry.
For primary bibliographic entry see Field 5B.
W78-09575

LIGHT-MEDIATED RECOVERY OF N2-FIXATION IN THE BLUE-GREEN ALGAE ANABAENA SPP. IN O2 SUPERSATURATED WATERS,
Department of Scientific and Industrial Research, Taupo (New Zealand). Freshwater Section.
H. W. Paerl.
Oecologia, Vol. 32, 1978, p 135-139, 2 fig, 1 tab, 11 ref.

Descriptors: Environmental effects, *Light, * Algae, *Nitrogen fixation, *Oxygen, *Supersaturation, *Cyanophyta, Water pollution effects, *Anabena.

In spite of the fact that N2-fixation in blue-green algae is known to be O2 sensitive, two species of Anabeana have been found to be capable of

neturalizing the inhibitory effects of O2, possibly by employing reductive processes in the cell. The process is light-mediated. It was concluded that nitrogenase recovery by Anabaena in response to O2 supersaturation mAy be an adaptive mechanism during blooms. The mechanism represents optimization of radiant energy. (Chilton-ORNL)
W78-09576

FOOD-CHAIN RELATIONSHIPS IN SUBTIDAL SILTY SAND MARINE SEDIMENTS AND THE ROLE OF MEIOFAUNA IN STIMULATING BACTERIAL PRODUCTIVITY,
Institut fur Meeresforschung, Bremerhaven (West Germany).
For primary bibliographic entry see Field 6G.
W78-09578

LIGHT EFFECTS ON NUTRIENT-LIMITED, OCEANIC PRIMARY PRODUCTION,
Oceanic Inst., Waimanalo, Hawaii.
P. Bienfang, and K. Gundersen.
Marine Biology, Vol 43, No 3, 1977, p 187-199, 9 fig, 1 tab, 57 ref. NSF DES 75-14110 and DES 15-03608.

Descriptors: *Environmental effects, *Light, *Productivity, Photosynthesis, *Primary production, *Phytoplankton, Growth rates, Nutrients, Nutrient requirements.

This work describes the controlling effect of ambient light upon phytoplankton dynamics throughout several oligotrophic water columns, when both light quality and quantity influence the phytoplankton response and where the photic substrate is measured in physiologically meaningful units of visible quanta flux. Ambient nutrients, vertical light profiles, phytoplankton biomass, and primary production were measured. Vertical profiles of phytoplankton activity and incident quanta flux are analyzed in terms of a substrate limited system. Comparison of data from isolated oceanic regions with data from near a shore station indicates that although large differences in the phytoplankton parameters exist throughout the entire photic zones of these regions, the hyperbolic A(z)-q(z) relationship describes the data fairly well in both cases. It is suggested that this relationship may apply to the general case of an oligotrophic water column. (Chilton-ORNL)
W78-09580

TOXICITY EVALUATION OF A COMPLEX METAL MIXTURE TO THE SOFTSHELL CLAM MYA ARENARIA,
Environmental Research Lab., Narragansett, RI.
R. Eisler.
Marine Biology, Vol 43, No 3, 1977, p 265-276, 7 fig, 7 tab, 20 ref.

Descriptors: Environmental effects, *Water pollution effects, *Metals, Toxicity, *Clams, Aquatic animals, Manganese, Zinc, Lead, Nickel, Copper, Cadmium, Mortality, Biomagnification, Mya arenaria.

Adult clams were continuously subjected to a flowing seawater solution containing 7200 microg/l Mn, 2500 microg/l Zn, 70 microg/l Pb, 50 microg/l Ni, 50 microg/l Cu, and 1 microg/l Cd. They were also subjected to solutions of 20% strength of the above amounts. Experiment 1 was conducted at 0 to 10C and Experiment 2 at 16 to 20C. In Experiment I, all clams exposed to 100% solution died between the 4th and 10th week. Survivors at 6 weeks contained 19 times more Pb, 14 x more Zn, 12 x more Cu, 10 x more Mn, 3 x more Ni, and 0.1 x more Cd than controls with minor whole body elemental changes. Clams exposed to 20% solution survived for the 112 day experimental period and at that time contained 5 x more Cu, 4 x more Mn, 3 x more Zn, and 2 x more Pb than controls. In Experiment 2, all animals exposed to 100% solution died between 6 and 14 days. At 7 days survivors contained 25 x more Pb, 13 x more Cu, 11 x more Zn, 7 x more Mn, and 3 x more Ni than controls. Mortality in animals exposed to 20% solution was only slightly higher than controls with survivors at 14 days containing 12 x more Mn, 7 x more Pb, 7 x more Zn, 4 x more Cu, and more Ni than controls. (Chilton-ORNL)
W78-09584

EFFECTS OF SALINITY ON FOOD INTAKE, ABSORPTION AND CONVERSION IN THE RAINBOW TROUT SALMO GAIRDNERI,
Stirling Univ. (Scotland). Dept. of Biology.
M. G. McLeod.
Marine Biology, Vol. 43, No. 2, 1977, p 93-102, 7 fig, 3 tab, 38 ref.

Descriptors: Environmental effects, *Salinity, Troyut, *Rainbow trout, Absorption, Foods, Food habits, Growth rate, *Water pollution effects, Food intake(Fish), Energy conversion(Fish).

Trout were acclimated to salinities of freshwater, 7.5, 15.0, 28.0, and 32.5% and temperature of 10C. At each change in salinity during the step-wise acclimation, there was a decrease in growth rate which could be accounted for by a fall in food intake. The greatest decrease in food intake and growth rate occurred after the increase of salinity from 15.0 to 28.0%. Recovery of food intake and growth rate to pre-change levels occurred within 14 days. Food absorption efficiency was calculated in terms of total dry matter, energy and total nitrogen. There was a negative linear relationship between salinity and absorption efficiency. Conversion efficiency was calculated in the same terms. A tendency for conversion efficiency to decline with salinity, especially between 28.0 and 32.5%, was observed. (Chilton-ORNL)
W78-09586

EFFECTS OF SALINITY ON FASTED RAINBOW TROUT, SALMO GAIRDNERI,
Stirling Univ. (Scotland). Dept. of Botany.
M. G. MacLeod.
Marine Biology, Vol. 43, No. 2, 1977, p 103-107, 3 fig, 12 ref.

Descriptors: Environmental effects, *Salinity, *Rainbow trout, Nutrient removal, Nutrient requirements, Weight, *Water pollution effects, Fasting(Fish).

Rainbow trout which had been acclimated for 120 days in freshwater and at salinities of 7.5, 15.0, and 32.5% at 10C were fasted for up to 48 days under the same conditions. It was found that weight loss could be adequately described by a straight line between Days 7 and 48. Mean weight losses in trout weighting 100 to 155 g and 80 to 95 g over the whole period in fresh water and salinities of 7.5 and 15.0% were 11 and 15% respectively. During the period from 20 to 48 days, trout maintained in 32.5% S lost significantly more weight than trout in the other three salinities. Muscle water and liver water content of trout maintained at 32.5% S decreased between Days 19 and 37. (Chilton-ORNL)
W78-09588

THE SOLUBILITY OF AROCLOR 1254 IN SEA-WATER,
Oregon State Univ., Corvallis. School of Oceanography.
For primary bibliographic entry see Field 5A.
W78-09589

MIREX INCORPORATION IN THE ENVIRONMENT: TOXICITY IN HYDRA,
Mississippi State Univ., Mississippi State. Dept. of Zoology.
K. Y. Luc, and A. A. de la Cruz.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 4, April, 1978, p 412-416, 3 tab, 24 ref.

Descriptors: Environmental effects, *Water pollution effects, Pesticides, Absorption, Invertebrates, Aquatic life, *Toxicity, *Mortality, Freshwater, *Mirex, Hydra.

This study is part of a series of investigations on the toxicity, physiological and ecological effects of mirex to non-target organisms. Behavioral changes (retraction of body tubes and tentacles) were observed when hydra were exposed to various concentrations of mirex solution. Mortalities of 78%, 20%, and 6% occurred after 144 hours of exposure to mirex solutions at concentrations of 1.0, 0.1, and 0.01 ppm respectively. Peak mortality occurred ater 96 hours exposure at 1.0 ppm concentration. It was suggested that, although the toxicity of mirex in this experiment appears to be low, the slow or delayed action of mirex and its biological magnification in animal tissue should not be overlooked. (Chilton-ORNL)
W78-09590

EFFECT OF DDT ON NADH-CYTOCHROME B5 REDUCTASE ACTIVITY IN THE FRESH-WATER PLANARIAN, PHAGOCATA VELATA,
Middle Tennessee State Univ., Murfreesboro. Dept. of Biology.
R. L. Baldwin, and M. R. Wells.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 4, April, 1978, p 428-430, 1 fig, 9 ref.

Descriptors: Environmental effects, *Water pollution effects, Insecticides, *DDT, Aquatic animals, Freshwater, Invertebrates, *NADH-cytochrome reductase, *Enzymes, Planaria, *Phagocata velata.

P. velata fed DDT showed an initial increase in NADH-cytochrome reductase 6 hours after feeding followed by a decline in activity after 24 hour and a significant decline 120 hours after feeding. The ability of the species to encyst during unfavorable conditions appears to be complemented with a system of microsomal enzymes capable of degrading chemicals known to be harmful in higher organisms. (Chilton-ORNL)
W78-09591

THE TOXICITY OF MCPA TO FISH. LIGHT AND ELECTRON MICROSCOPY AND THE CHEMICAL ANALYSIS OF THE TISSUE,
Jyvaskyla Univ., (Finland). Dept. of Chemistry.
M. L. Hattula, H. Reunanen, and A. U. Arstila.
Bulletin of Environmental Contamination and Toxicology, Vol. 19, No. 4, April, 1978, p 465-470, 1 tab, 8 ref.

Descriptors: Environmental effects, *Water pollution effects, Herbicides, Fish, Toxicity, Acetic acid, Organic wastes, Chemical analysis, Electron microscopy, MCPA, 4-o-cresol, 4-chloro-2-phenoxyacetic acid.

Investigations showed that fish tissues concentrated 4-chloro-2-phenoxyacetic acid (MCPA) in the same amount in spite of differences in water concentrations. Histopathological studies showed no changes in fish tissue at exposure levels of 10-60 ppm MCPA. Fish which lived only 3-5 days in 100 ppm commercial MCPA were found to live over 10 days in pure grade MCPA. Tissue concentrations of 4-o-cresol were five times greater in fish exposed to commercial product leading to the conclusion that this impurity, which is fat soluble rather than water soluble as the pure grade MCPA is, caused the earlier death of the fish. It was concluded that pure grade MCPA is relatively safe to fish. (Chilton-ORNL)
W78-09592

REVIEW OF CURRENT LITERATURE CONCERNING THE ACUTE AND CHRONIC EFFECTS OF PESTICIDES ON AQUATIC ORGANISMS,
Florida State Univ., Tallahassee. Dept. of Biological Science.
R. J. Livingston.
CRC Critical Reviews in Environmental Control, Vol. 7, No. 4, November 1977, p 325-351, 3 tab, 258 ref.

Descriptors: Environmental effects, *Water pollution effects, Pesticides, Aquatic life, Toxicity, *Reviews, *Literature reviews, *Bibliography, *Pesticide toxicity.

This review physiochemical and biological inplication of the use of herbicides, fungicides, and organochlorine, organophosphate, and carbamate insecticides. Diversity of formulation and variability of environmental effets from one habitat to the next complicates the determination of safe concentrations of pesticides in the aquatic system. Information on the acute toxicity of selected pesticides is presented in tabular form. It was concluded that the ultimate determination of environmental impact due to pesticide contamination is long-term, comprehensive field analysis and that it is in this area that there is the least amount of information available. (Chilton-ORNL)
W78-09595

METALS IN AN ACID MINE STREAM AND ESTUARY,
University Coll. of North Wales, Menai Bridge. Marine Science Labs.
For primary bibliographic entry see Field 5B.
W78-09596

CHARACTERIZATION AND IMPACT OF STORMWATER RUNOFF FROM VARIOUS LAND COVER TYPES,
Wiggins-Rimer and Associates, Durham, NC.
For primary bibliographic entry see Field 5B.
W78-09598

AN IN SITU DETERMINATION OF THE DISAPPEARANCE OF COLIFORMS IN LAKE MICHIGAN,
Marquette Univ., Milwaukee, WI.
For primary bibliographic entry see Field 5B.
W78-09599

ACUTE TOXICITY OF COPPER, CADMIUM, AND ZINC TO LARVAE OF THE CRAB PARAGRAPSUS QUADRIDENTATUS (H. MILNE EDWARDS), AND IMPLICATIONS FOR WATER QUALITY CRITERIA,
Victoria Ministry for Conservation Melbourne (Australia). Marine Pollution Studies Group.
M. Absanullah, and G. H. Arnott.
Australian Journal of Marine and Freshwater Research, Vol 29, No 1, February, 1978, p 1-8, 2 tab, 29 ref.

Descriptors: Environmental effects, *Water pollution effects, Water quality, Toxicity, *Copper, *Cadmium, *Zinc, Larvae, *Crabs, Paragrapsus quadridentatus.

Experiments showed larval/96-h LC50 values P. quadridentatus to be 0.17 mg/l/for copper, 0.49 mg/l for cadmium and 1.23 mg/l for zinc. Potency ratios of the three metals were Cu/Cd 3:1, Cu/Zn 7:2, and Cd/Zn 2:4. Larvae were found to be more sensitive to heavy metals than adults. Application of the 0.01 factor (recommended in Victorian water quality criteria) to 96-h LC50 values determined in this study gives concentrations which are below the recommended minimal risk concentrations for copper and zinc. In view of the known greater sensitivity of larvae to heavy metal toxicity, it is questioned whether the same application factor should be applied to LC50 data for both adult and larval stages. (Chilton-ORNL)
W78-09600

CHEMISTRY AND BIOLOGICAL HAZARD OF A COAL ASH SEEPAGE STREAM,
Oak Ridge National Lab., TN. Environmental Sciences Div.
C. C. Coutant, C. S. Wasserman, M. S. Chung, D. B. Rubin, and M. Manning.
Journal Water Pollution Control Federation, Vol 50, No 4, April, 1978, p 747-753, 1 fig, 3 tab, 12 ref.

Descriptors: Environmental effects, *Water pollution effects, Fossil fuels, Waste water(Pollution), Acidic water, Ash ponds, *Coal ash, Seepage.

This study was conducted to characterize the chemical nature and biological hazard of seepage water flows from ash pond systems of coal-fired electric power stations. The study was conducted at the TVA's Bull Run Steam Plant. It was found that acidic, iron-rich seepage water is produced within the ash deposits through physical and microbiological process. These seepage conditions may mobilize the contaminants. An iron floc results when the acidic seepage enters the slightly alkaline river water, which is detrimental to fish and bottom organisms in the area. (Chilton-ORNL)
W78-09602

INVESTIGATION OF SELECTED POTENTIAL ENVIRONMENTAL CONTAMINANTS: NITROAROMATICS,
Syracuse Research Corps., NY. Center for Chemical Hazard Assessment.
For primary bibliographic entry see Field 5B.
W78-09795

FIELD AND LABORATORY PROTOCOLS FOR EVALUATING THE EFFECTS OF CHEMICAL SUBSTANCES ON AQUATIC LIFE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Biology.
J. Cairns, Jr., and K. L. Dickson.
Journal of Testing Evaluation, 1978, Vol. 6, No. 2, p 81-90. 1 tab, 2 fig, 18 ref.

Descriptors: Methodology, *Bioassay, *Laboratory tests, Laboratory equipment, *On-site investigations, Aquatic animals, Aquatic environment, Water pollution, *Water pollution effects, Toxicity, *Chemicals, Chemical wastes.

One of the difficulties of evaluating the hazard associated with the release of a chemical substance into the environment is to determine how much testing is necessary to delimit its effects adequately. Since different classes of toxicants have different biological effects, it would be wasteful of both time and money to carry out extremely detailed and comprehensive tests for even the most innocuous materials. It would be equally inappropriate to carry out limited tests for very dangerous materials-as painful experience has already shown. Protocols to sort out which materials require extensive testing and which do not, as well as which decision criteria should be at each stage in a test series, are essential to the establishment of reasonable water quality standards. This true not only for laboratory studies but also for assessments of effects in the receiving system itself. Two illustrative protocols, one for the laboratory studies of aquatic organisms and the other for field studies in freshwater receiving systems, are described. (EIS-Katz)
W78-09796

THE EFFECTS OF ALTERED STREAMFLOWS ON FISH AND WILDLIFE IN CALIFORNIA,
Jones and Stokes Associates, Inc.,
C. Hazel.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 245, Price codes: A01 in paper copy, A01 in microfiche. Fish and Wildlife Service Report OBS-76/33, Dec. 1976, 48 p, 34 ab, 7 fig, 13 ref.

Descriptors: *California, Methodology, Dams, Freshwater fish, Stream fisheries, Streams, *Streamflow, Water allocation(Policy), Water control, Water policy, Water resources, Water rights, Water structure, Water development, Hydrology, *Minimum flow, *Instream flow, *Water release management.

This report contains analysis findings, and conclusions and recommendations regarding changed flow regimes below dams, the impact of fisheries, and methodologies used to assess flow requirements for 46 dams and diversions in California. (EIS-Katz)
W78-09798

5D. Waste Treatment Processes

RECYCLING AND WATER QUALITY,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6D.
W78-09316

FLOCCULATION-FLOTATION AIDS FOR TREATMENT OF COMBINED SEWER OVERFLOWS,
Hercules Inc., Cumberland, MD. Allegany Ballistics Lab.
N. F. Stanley, and P. R. Evans.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 780, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-140, August 1977. 92 p, 17 fig, 29 tab, 7 ref.

Descriptors: *Flotation, *Flocculation, *Coagulation, *Chemical reactions, *Floats, Suspended solids, Cleaning, Storm water, Overflow, Combined sewers, Waste water treatment, Municipal wastes.

Chemical flocculants and buoyant flotation aids were investigated for removing suspended solids from combined sewer overflows. Laboratory batch tests achieved a 70-100% suspended solids removal when 100 mg/liter of the polystrene flotation aid Dylex KCD-340, 100 mg/liter of FeC13 as a coagulant, and 1 mg/liter of Hercofloc 810 as a flocculant were added. In pilot plant tests, the flocculants and buoyancy aids lost their effectiveness when stored for long periods of times. Suspended solids were reduced by 67-87% when problems with the chemicals and buoyancy aids were corrected; suspended solids were reduced by 50-77% with air flotation in the same pilot plant. The success of the process was considered economically dependent upon recovery and reuse of the flotation aids. Cleaning the flotation aid surface of adhering solids for reuse in the flocculation-flotation process was unsuccessful. Further investigations of the process were rejected in favor of air flotation treatment of combined storm overflows. (Lisk-FIRL)
W78-09364

PERFORMANCE EVALUATION OF EXISTING LAGOONS-PETERBOROUGH, NEW HAMPSHIRE,
JBF Scientific Corp., Wilmington, MA.
S. P. Bowen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 390, Price codes: A06 in paper copy, A01 in microfiche. Report EPA-600/2-77-085, August 1977. 101 p, 6 fig, 6 tab, 2 append.

Descriptors:· *Sewage lagoons, *Ponds, *Chlorination, *Coliforms, *Biochemical oxygen demand, Oxidation lagoons, Chemical oxygen demand, Suspended solids, Alkalinity, Anaerobic

conditions, Freezing, Aeration, Waste water treatment, Sampling, Monitoring, Municipal wastes.

The performance of waste water treatment lagoons in Peterborough, New Hampshire, was monitored over a 12-month period with respect to federal standards for effluent quality. The treatment plant had average and design flows of 0.5 mgd and 2.14 mgd, respectively; three treatment lagoons without aeration had a total surface area of 21 acres. Chlorination of the treated effluent was conducted before discharge. Fecal coliforms and suspended solids were efficiently removed during the entire study; BOD and COD were adequately reduced during all but four months of the study. During these winter months, total BOD was reduced by 60% to about 52 mg/liter and pH dropped to below 6.0. The reduced efficienty of the treatement lagoons was attributed to anaerobic conditions created by an ice cover. The installation of induced air aeration equipment in one or more ponds was recommended. A 27% seepage loss was recorded in the plant which was BOD and hydraulically underloaded. Average effluent dissolved oxygen levels of 2 mg/liter dropped to zero during the winter months; ammonia-nitrogen concentrations increased and nitrate-nitrogen decreased during the cold periods. Total phosphorus was reduced by about 10% for the year; nitrate-nitrogen was removed to below detectable levels. Alkalinity doubled during the winter months because of the necessary increase in residual chlorine levels from 2 mg/liter to 40-50 mg/liter. (Lisk-FIRL)
W78-09365

DOWNFLOW GRANULAR FILTRATION OF ACTIVATED SLUDGE EFFLUENTS,
District of Columbia Dept. of Environmental Services, Washington. EPA-DC Pilot Plant.
R. P. G. Bowker.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB-272 317, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-660/2-77-144, Sept 1977. 55 p, 16 fig, 6 tab, 6 ref, 1 append.

Descriptors: *Activated sludge, *Filtration, *Sands, *Coals, *Suspended solids, Flow rates, Filters, Granules, Porous meida, Hydraulic systems, Pilot plants, Waste water treatment, Municipal wastes.

The impact of downflow granular filtratin media properties on activated sludge effluents from plug flow, complete mixing, and step aeration operations was evaluated in pilot plant studies. The filtration media consisted of anthracite in particle sizes ranging 1.0-2.0 mm, with or without sand with effective particle sizes of 0.4-0.9 mm. The media depth in the filter was varied over 38-64 cm for the anthracite and 30-38 cm for sand. Hydraulic loadings on 0.1 sq m filters were varied over 3-9 gpm/sq ft. Breakthrough of suspended solids in the activated sludge treated waste water occurred during tests with single media anthracite with particle sizes of 1.65 and 2.0 mm. Breakthrough was observed to increase at higher flow rates. With a dual media of 2.0 mm anthracite and 0.9 mm sand, higher quality effluent was obtained with higher suspended solids loadings and longer run times. Backwashing tests of the dual filter media demonstrated that a 13% bed fluidization at a 35 gpm/sq ft flow rate was effective in cleaning. The growth of filamentous organisms and Nordica species interfered with some of the experiments, as did low suspended solids concentrations in some of the activated sludge influent. (Lisk-FIRL)
W78-09366

WASTEWATER DEMINERALIZATION BY TWO-STAGE FIXED-BED ION EXCHANGE PROCESS,
Los Angeles County Sanitation Districts, Whittier, CA.
C. L. Chen, and R. P. Miele.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 591, Price codes: A05 in paper copy, A01 in microfiche. Report EPA-600/2-77-146, Sept 1977. 81 p, 19 fig, 27 tab, 4 ref.

Descriptors: *Ion exchange, *Demineralization, *Carbon, *Adsorption, *Resins, Anion exchange, Cation exchange, Dissolved solids, Pilot plants, Waste water treatment, Municipal wastes.

A 2.5 gpm two-stage and an automated 4 gpm single-staged fixed ion exchange pilot plant were used to investigate the impact of carbon adsorption pretreatment of waste water on ion exchange performance. The 2.5 gpm pilot plant, located in the sewage treatment plant at Pomona, California, contained primary cation, primary anion, secondary cation, and secondary anion exchange columns, operated in series. Regenerants were first applied to the secondary exchange columns and then to the primary columns in a downflow direction to insure monovalent ion removal efficiency from the secondary columns. Resin longevity studies were conducted with the 4 gpm single-stage pilot plant over 32 mos. Resins remained stable throughout the tests. The two-stage plant reduced total dissolved solids by 90% at regenerant concentrations of 17.6 gal/liter H_2SO_4 in the cation column with 85% regeneration efficiency and 9.6 gal/liter NH_3 in the anion exchanger with 90% regeneration efficiency. Costs associated with reducing total dissolved solids from 600 to 60 mg/liter in a 10 mgd operation were $0.059/1,000 liters. (Lisk-FIRL)
W78-09367

FEASIBILITY OF TREATING SEPTIC TANK WASTE BY ACTIVATED SLUDGE,
District of Columbia Dept. of Environmental Services, Washington. EPA-DC Pilot Plant.
S. M. Bennett, J. A. Heidman, and J. F. Kreissl.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 105, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-141, August 1977. 67 p, 17 fig, 12 tab, 10 ref.

Descriptors: *Activated sludge, *Septic tanks, *Domestic wastes, *Pilot plants, *Treatment facilities, Continuous flow, Organic loading, Chemical oxygen demand, Performance, Aeration, Sludge treatment, Waste water treatment, Municipal wastes.

Pilot plant studies evaluated the impact of septic tank wastes on municipal activated sludge treatment facilities. Septic tank pumpings, generated at an estimated volume of 13 million cu m/yr, were introduced into a 1,980 gpd activated sludge pilot plant on a continuous flow basis and on a shock load basis. Batch aeration tests were also conducted for the shock load studies. A control unit treating only primary effluent was also operated over the four month study period. The municipal activated sludge pilot plant was able to accommodate both continuous and intermittent loads of septic tank wastes without significant interference with effluent quality. While the strength and organic loading of the septic wastes introduced on a continuous feed basis influenced the response of the activated sludge system, wastes with COD levels below 3 g/g mixed liquor volatile suspended solids/day did not disrupt treatment performance. Unacclimated activated sludge systems were also able to accommodate septage. Results of the study also indicate that sufficient excess aeration, especially for shock septage loads, and adequate sludge handling facilities are necessary for municipal activated sludge treatment of septic wastes. (Lisk-FIRL)
W78-09368

USER ACCEPTANCE OF WASTEWATER SLUDGE COMPOST,
Culp/Wesner/Culp, Clean Water Consultants, El Dorado Hills, CA.
For primary bibliographic entry see Field 5E.
W78-09370

STORM SEWAGE: SEPARATION AND DISPOSAL,
R. McGillivray.
Public Health Engineer, Vol. 6, No. 2, p 90-93, 1978.

Descriptors: *Storm drains, *Storm water, *Surface runoff, *Sewerage, *Overflow, Urban runoff, Drainage water, Surface waters, Rain water, Combined sewers, Storm runoff, Equipment, Pipes, Storage tanks, Settling basins, Construction materials, Waste water treatment.

Considerations in designing storm water disposal sewers were discussed in a symposium sponsored by the Scottish District Center and attended by the Scottish Working Party on Storm Sewage in Glasgow, Scotland, on December 14, 1977. Increases in dry weather sewage flows, industrial discharges to municipal sewers, water removal from rivers, paved areas, and changes in the properties of surfaces runoff have mandated the investigation of pollutants in surface runoff and separated or combined storm sewer designs. About 20% of the storm water overflows reported by districts in Scotland were termed unsatisfactory; the overflows had BOD concentrations in the range of 25-50% of those found in dry weather sewage flows. River purification boards in Scotland have adopted regulations allowing parts of industrial complexes to be connected to sanitary sewers, eliminating dual manholes functioning for separated sanitary and storm sewer systems, and encouraging the use of different pipe materials, such as fireclay and concrete, for sanitary sewers and for storm sewers to assist in identification. Stilling ponds were recommended for overflow systems to reduce flow velocities, reduce turbulence, and promote settling. High side-weirs were considered the most efficient means of overflow control. Storm sewer installations in several Scottish municipalities, pilot plant studies of storm water tanks, and combined sewer investigations were reviewed. (Lisk-FIRL)
W78-09371

TAKE THE PICK AND SHOVEL WORK OUT OF COMPUTATION,
For primary bibliographic entry see Field 7C.
W78-09372

OCEAN BAN BUOYS SLUDGE PROCESSES.
For primary bibliographic entry see Field 5E.
W78-09373

U-TUBE CONNECTIONS FOR WASTEWATER PONDS,
Tenneco Chemicals, Pasadena, TX.
For primary bibliographic entry see Field 8C.
W78-09374

CHICAGO PIONEERS IN CORRECTING WATER POLLUTION, CONTROLLING FLOODS.
Civil Engineering-ASCE, Vol. 48, No. 7, p 58-62, July, 1978. 5 fig, 1 tab.

Descriptors: *Tunnels, *Detention reservoirs, *Combined sewers, *Flooding, *Stream improvement, Excavation, Tunneling machines, Overflow, Storm runoff, Tunnel construction, Aeration, Reservoir storage, Tertiary treatment, Treatment facilities, Waste water treatment, Storm water, Municipal wastes, Sewerage.

A $2.8 billion Tunnel and Reservoir Plan under construction in Chicago, Illinois, will intercept combined sewer overflows and store the waste water for subsequent treatment when the storm subsides. The first phase of the project includes the excavation with a tunnel boring machine of 13-

35 ft or 4.0-10.7 m diameter tunnels in the limestone strata 200 ft below the surface. The tunnel will receive an unreinforced surface coating to reduce rock breakage within the tunnel and to prevent exfiltration of sewage into aquifers which have a higher water table than the tunnels. Overflows will be retained in the tunnels and in a series of five reservoirs during storms and will be pumped to the treatment plants when dry weather flow resumes. As a cost-effective alternative to upgrading waste water treatment plants to tertiary treatment, instream aeration was chosen to maintain dissolved oxygen levels in receiving streams. Ten aeration units will supply an average of 165,300 lb 02/day to streams; instream aeration has the advantage of reducing non-point source pollutants that would not reach treatment plants. Districts lying outside Chicago's combined sewer system will be protected from flood damage by channel improvements and the construction of six reservoirs in the Upper Salt Creek Watershed. (Lisk-FIRL)
W78-09375

PROGRAM THE MANNING EQUATION,
Camp, Dresser, and McKee Inc., Boston, MA.
For primary bibliographic entry see Field 7B.
W78-09376

KNOW-HOW IMPORTANT IN REHABILITATING FLOODED SEWER LINES,
Pennsylvania Dept. of Public Works, Johnstown.
For primary bibliographic entry see Field 8G.
W78-09377

INNOVATIVE DESIGN SLATED FOR TEXAS TOWN,
Bovay Engineers, Inc., Houston, TX.
S. B. Garland, and D. F. Werner.
Water and Wastes Engineering, Vol. 15, No. 3, p 32, 34, 38, March, 1978. 3 fig, 1 tab.

Descriptors: *Treatment facilities, *Equalizing reservoirs, *Oxidation lagoons, *Sludge digestion, *Storage tanks, Storm water, Storm surge, Aeration, Jets, Dewatering, Chlorination, Disinfection, Waste water treatment, Municipal wastes.

A 2.45 mgd contact stabilization plant operating in conjunction with an existing 0.85 mgd plant was designed for Lake Jackson, Texas, to accomodate peak flows up to 16.5 mgd. Primary treatment consists of screening and grit removal with Dyneco's Aqua-Guard, employing bar screen openings of 0.25 inches. An equalization/surge basin was selected for storing the peak storm water flows and for on-line control of diurnal fluctuations. Overflows in the two-section 700,000 gal equalization basin pass over a weir into the storage basin where the waste water is used as makeup when the peak flow subsides. The two-channel configuration provides a backup system when one channel is under repair and reduces the energy required for mixing waste ater in a 700,000 gal tank. Pentech jet aerators at a depth of 22 ft were selected for the contact, equalization, and stabilization tanks, and for the aerobic digesters because of their lower power requirements. The aerators are guaranteed to maintain a dissolved oxygen concentration above 2 mg/liter and a tank bottom velocity of 1 ft/sec. The Leopold Clair-Vac floating siphon sludge collector accomodated the design specifications for size, shape, operation, and maintenance. Sludge is aerobically digested, gravity thickened, and dewatered by a belt filter press; scum is transported by an air lift pump to the filter press. Before discharge, the treated effluent is chlorinated for a contact period of 20 min with a Pentech jet disinfection system. (Lisk-FIRL)
W78-09378

REDUCING COLIFORM AND SALMONELLA BACTERIA DURING ANAEROBIC DIGESTION,
Vanderbilt Univ., Nashville, TN. Dept. of Environmental Engineering ad Policy Management.
M. B. Cooke, E. L. Thackston, and G. W. Malaney.
Water and Sewage Works, Vol. 125, No. 1, p 50-53, January, 1978. 4 fig, 2 tab.

Descriptors: *Salmonella, *Coliforms, *Anaerobic digestion, *Sewage bacteria, *Sampling, Pathogenic bacteria, Treatment facilities, Analytical techniques, Water pollution sources, Waste water treatment, Municipal wastes.

The reduction of salmonellae and coliforms by anaerobic digestion was examined in three sewage treatment plants in Tennessee. Samples of primary-treated and anaerobically-digested sludge were collected from each plant over three days and analyzed by the multiple tube fermentation technique for coliforms and by the Alley-Malaney membrane filter technique for salmonellae. Similar coliform concentrations before digestion were apparent in raw sludge from all three plants; anaerobic digestion at the two Murfreesboro treatment plants reduced coliforms by 10,000-fold on the third sampling day, while significantly lower reductions were observed in Nashville's Dry Creek plant. Salmonellae concentration by 1,000-10,000-fold, while concentrations were reduced 100-fold by the Dry Creek plant. The greater reductions at the Murfreesboro plants were attributed to detention times of 50 and 38 days; Dry Creek detention time averaged 9 days. (Lisk-FIRL)
W78-09379

SOME TESTS ON THE MEMBRANE FILTER PLATE,
Severn-Trent Water Authority, Birmingham (England).
For primary bibliographic entry see Field 5E.
W78-09380

WASTEWATER TREATMENT PLANT IS REGIONAL SUCCESS,
Gwin, Dobson and Foreman, Inc., Altoona, PA.
R. T. Dobson.
Water and Wastes Engineering, Vol. 15, No. 1, p 46-48, January, 1978. 1 fig, 2 tab.

Descriptors: *Treatment facilities, *Activated sludge, *Aeration, *Sludge treatment, *Pulp and paper industry, Chlorination, Incineration, Dewatering, Polymers, Interceptor sewers, Disinfection, Sludge disposal, Waste water treatment, Municipal wastes, Concrete pipes, Construction materials.

A regional waste water treatment plant in Tyrone, Pennsylvania, treats 9.0 mgd of combined municipal and paper mill wastes. One-third of the design flow is generated by the Westvaco Corp. paper mill which provides primary treatment of its wastes; provisions have been made to expand the municipal treatment plant to 30 mgd. The waste water receives comminution, primary clarification and chlorination. Paper mill sludges with a high clay content are mixed with sewage sludges, conditioned with polymers, thickened, centrifuged, incinerated in a fluidized bed reactor, and discharged to a landfill. Effluent during the initial phase of operation contained 15.6 mg/liter BOD and 19.8 mg/liter suspended solids. A 3,000-linear ft reinforced concrete interceptor sewer with a diameter of 48 inches and a capacity of 36 mgd was constructed to connect the new treatment facility to the site of the former treatment plant. (Lisk-FIRL)
W78-09381

CENTRAL PIVOT SPRAY SYSTEM CONTROL STORM LAKE POLLUTION,
J. C. Rosse.
Water and Sewage Works, Vol. 125, No. 1, p 72-75, January, 1978. 2 tab.

Descriptors: *Spray irrigation, *Oxidation lagoons, *Biological treatment, *Aeration, *Storage tanks, Irrigation practices, Pilot plants, Return flow, Crop production, Soybeans, Corn(Field), Treatment facilities, Ammonia, Nutrients, Waste water treatment, Groundwater, Industrial wastes, Municipal wastes, Fishkill.

A system of lagoon treatment, storage, and central pivot spray irrigation has been installed to treat combined municipal and industrial food processing waste flow in Storm Lake, Iowa. The waste water, containing high concentrations of ammonia-nitrogen and sulfate, is treated in two waste water plants and/or diverted to the lagoons which provide biological treatment, stabilization, anaerobic and aerobic treatment, and storage. The stored waste water is used to spray irrigate leased cropland; a 630-ft Model 2071 Valley electric drive center pivot system with five drive towers irrigates a 33-acre circle. Pilot plant studies on a 40-acre tract planted with corn crop during the growing season increased the yield by 30%; 18.7 inches applied to a soybean crop increased the yield by up to 100%. Groundwater studies have indicated that waste water applications up to 18.7 inches/yr would not adversely affect groundwater, dependent upon annual precipitation. Waste water is stored during the winter months when ammonia-nitrogen levels are the highest to prevent fishkill in the receiving streams. (Lisk-FIRL)
W78-09382

EFFLUENT TREATMENT PROCESS USES FILAMENT-WOUND GLASS FIBER/EPOXY.
For primary bibliographic entry see Field 8G.
W78-09383

NEW HAMPSHIRE SECTION NAMES TREATMENT FACILITY STATE'S OUTSTANDING CI ACHIEVEMENT,
B. M. Lally.
Civil Engineering-ASCE, Vol. 48, No. 2, p 84-85, February, 1978.

Descriptors: *Treatment facilities, *Sludge treatment, *Incineration, *Aeration basins, *Chlorination, Air circulation, Instrumentation, Automation, Ozone, Gases, Waste water treatment, Interceptor sewers, Municipal wastes.

The New Hampshire division of the American Society of Civil Engineers has cited the Manchester, New Hampshire, 26 mgd waste water treatment plant as a significant engineering achievement. The waste water treatment project provides for the construction of 20 miles of interceptor sewers, a pumping plant, and expansion of the facility to 60 mgd. The treatment facility, which will reduce the pollution load on the Merrimack River, provides secondary waste water treatment with 2 primary and 2 secondary clarifiers, aeration basins, chlorination, sludge thickening, and sludge incineration. Venturi scrubbers mounted in the incinerators reduce the particulate emissions into the air. The treatment system is electrically monitored and remotely controlled; gas analyzers and negative room pressure equipment have been installed in potentially hazardous areas of the plant. Air exhausted from these areas by negative pressure is treated with ozone for deodorizing the gases before release. Air in areas containing toxic or explosive supplies is exchanged 12 times/hr. (Lisk-FIRL)
W78-09384

HOME REMEDY HELPS FIGHT SLUDGE BULKING,
N. Barber.
Water and Sewage Works, Vol. 125, No. 4, p 45-46, April, 1978. 2 fig, 1 tab.

Descriptors: *Sodium compounds, *Neutralization, *Sludge treatment, *Coagulation, *Aerated lagoons, Food processing industry, Al-

kalinity, Treatment facilities, Chlorination, Suspended solids, Biochemical oxygen demand, Waste water treatment, Municipal wastes.

Sodium bicarbonate treatment of waste water bearing large volumes of high pH, starchy industrial wastes has improved sludge settleability in the Wilbraham, Massachusetts, municipal waste water treatment facility. The treatment plant has fluctuating volume and organic loads which range 30,000-130,000 gpd and 1500-2500 ppm BOD. The higher flow rates and BOD occur during the week when a potato chip plant and an ice cream plant are in operation. Waste water laden with starch and having a pH up to 12.2 flows to the plant once each week when the potato chip plant's tanks are washed. A 300 lb dose of sodium bicarbonate is added to the aeration tanks, followed by subsequent additions of 50 lb/day on Monday through Wednesday and 100 lb/day on Thursday and Friday. Aerated waste water is settled and chlorinated before discharge with 30 ppm BOD and suspended solids. The sludge volume index was decreased to 80-90, alkalinity was increased from 285-344 mg/liter and sludge solids content was increased by 1.5-2.5% with sodium bicarbonate treatment. Waste sludge volume decreased from 14,000-9,000 gpd and mixed liquor suspended solids increased from 6,460-11,600 ppm within 6 mos. (Lisk-FIRL)
W78-09385

PERFORMANCE, DESIGN AND OPERATION OF NORTHERN EXTENDED AERATION PLANTS,
Department of the Environment, Edmonton (Alberta). Northern Technology Center.
P. W. Given, and D. W. Smith.
Canadian Journal of Civil Engineering, Vol. 5, No. 1, p 70-82, March, 1978. 12 fig, 2 tab, 19 ref.

Descriptors: *Aerated lagoons, *North America, *Cold regions, *Performance, *Organic loading, Biochemical oxygen demand, Chemical oxygen demand, Suspended solids, Hydraulic structures, Waste water treatment, Municipal wastes.

The performance of extended aeration treatment plants in northern Canadian territories and Alaska with mean temperatures below freezing was compared in a literature review with the performance of plants located south of the O C mean annua isotherm and National Sanitation Foundation (NSF) plants. The northern plants were found to have stronger sewage than the non-northern plants with influent BOD and COD concentrations averaging 289 mg/liter and 722 mg/liter, respectively, in the northern regions and 156 mg/liter and 405 mg/liter, respectively, in the non-northern regions. BOD was reduced by 56%, COD by 51%, and suspended solids by 58% in the northern plants; the non-northern plants reduced BOD by 60%, COD by 47%, and suspended solids by 44%. Optimum remova rates established by NSF for BOD and suspended solids were 89% and 87%, respectively. Low performance standards in the northern treatment plants were attributed not to temperature but to hydraulic and organic overloading, failure to scrape the clarifiers and maintain sludge returns, and insufficient aeration. (Lisk-FIRL)
W78-09386

WAUSAU SOLVES DUAL PROBLEM BY USING FILTER PRESS,
Becher-Hoppe Engineers, Inc., Schofield, WI.
G. J. Bizjak, and A. E. Becher, Jr.
Water and Wastes Engineering, Vol. 15, No. 2, p 28-30, 32, February, 1978. 2 fig, 1 tab.

Descriptors: *Filtration, *Sludge treatment, *Dewatering, *Sewage sludge, *Water treatment, Filters, Porous media, Separation techniques, Sludge disposal, Landfills, Waste water treatment, Treatment facilities, Municipal wastes.

A Zimpress cloth filter press installed in the Wausau, Wisconsin, waste water treatment plant dewaters combined waste water and water treatment sludges. Thickened water treatment sludges, comprising about one-third of the daily 16,209 lbs of combined sludge treated, are mixed with waste water sludges in an oxidized storage tank where they are further concentrated from the initial 4% or higher solids content. The sludge flows by gravity to one of two ram-type filter press feed pumps with hydraulic capacities of 125 gpm at 100 lbs/sq inch. The flow-controlled, pressure-compensating filter press is floor mounted and contains cast iron plates controlled by an automatic mechanism. The press has a polypropelene-monofilament yarn filter with a surface area of 1,381.8 sq ft; under continuous operation, the press has a cycle time of 2.25 hrs. A filter cake with a total solids content of 45% is produced; the press frame allows for future expansion by 40%. Filtrate is returned to the aeration tanks and the sludge cake is disposed of in a landfill. The solids dewatering system cost a total of $429,678. (Lisk-FIRL)
W78-09387

RADIATION TREATMENT OF WASTE WATER,
Energy Research and Development Administration, Washington, DC. Div. of Biomedical and Environmental Research.
D. S. Ballantine.
Water Pollution Control, Vol. 77, No. 1, p 87-96, 1978. 8 fig, 3 tab, 35 ref.

Descriptors: *Radiation, *Gamma rays, *Electromagnetic waves, *Cobalt radioisotopes, *Nuclear wastes, Cesium, Nuclear reactors, Irradiation, Equipment, Disinfection, Sewage sludge, Waste water treatment, Municipal wastes.

Design criteria for radiation treatment of waste water are reviewed and two sewage irradiation systems are described. Radiation has been found to: reduce the BOD and COD concentrations in sewage; improve biodegradation; destroy cyanide and chlorinated organic pesticides; enhance settling, filtering, and dewatering properties of sludge; and disinfect pathogenic sewage bacteria. Electron accelerators and gamma radiation with cobalt-60 or cesium-137 are cited as the primary sources of radiation. Cesium-137 has the disadvantages of being less available, producing less kilowatts/curie, and diminishing by 50% through self-adsorption. Marketing of cobalt-60 is more extensive, but with increased use of nuclear power, cesium-137 will be more readily available. The Geisselbulach, West Germany, sewage treatment plant utilizes cobalt-60 to irridate municipal sludge for disinfection before land application; the system includes an irradiation shaft equipped with a reaction vessel and a recirculation system for complete exposure to the radiation. A 50 kilovolt electron accelerator utilized at the Dear Island Waste Treatment plant in Boston, Massachusetts, incorporates aeration and spreading of the sludge on a rotating drum which moves the sludge under the accelerator beam. Although the design sludge thickness is 2 mm, radiation from the electron accelerator penetrates to about 0.3 cm. A cost comparison of the three irradiation systems reported that a cobalt-60 source cost $0.89/kl, cesium-137 radiation cost $0.75/kl and a 3-million volt electron accelerator cost $0.40/kl of sludge treated. (Lisk-FIRL)
W78-09388

COMPUTER-CONTROLLED PLANT FEATURES ADVANCED TREATMENT.
Public Works, Vol. 109, No. 2, p 50-54, February, 1978. 2 tab.

Descriptors: *Computers, *Automation, *Tertiary treatment, *Activated sludge, *Instrumentation, Flowmeters, Settling basins, Aeration, Chlorination, Lime, Polymers, Sludge treatment, Dewatering, Filtration, Incineration, Monitoring, Sludge disposal, Waste water treatment, Municipal wastes.

A 12 mgd addition to an existing 4 mgd sewage treatment plant in the New Jersey township of Parsippany-Troy Hills was designed with computerized control. The plant addition includes: 2 grit chambers, 6 primary settling tanks, 6 diffused air aeration tanks with activated sludge, 6 final settling basins, and 2 chlorine contact tanks for sodium hypochlorite disinfection. A planned 18 mgd advanced waste water treatment addition will include: 4 nitrification tanks and clarifiers; 4 methanol reduction tanks, supplying about 9,100 lbs methanol/day; 4 denitrification tanks and clarifiers; and 8 multi-media filters, each with a 400 sq ft surface area. The 12 mgd addition will supplement the existing anaerobic digestion and vacuum filter dewatering of sludge with gravity thickening of primary sludge and air flotation of waste activated sludge. It will also incorporate chemical conditioning with lime, aluminum chloride, and polymers; vacuum filter dewatering; incineration in two multiple hearth furnaces; and ash storage in lagoons. Control of the plant is maintained by a Fischer and Port computer-based real time system with a dual computer arrangement. The computer system controls 14 plant operations and monitors 9 others with magnetic flowmeters in the plant addition. The computer system controls flows to the primary settling tanks, to the aeration tanks, to the secondary settling basins, and activated sludge, the air flow in the diffused aeration tanks; the number of blowers on-line, primary sludge pumping, and sodium hypochlorite disinfection are also computer controlled. (Lisk-FIRL)
W78-09389

UNIQUE SLUDGE HANDLING SYSTEM CHOSEN IN DUBUQUE,
Henningson, Durham, and Richardson, Omaha NE. Environmental Engineering Dept.
For primary bibliographic entry see Field 5E.
W78-09390

CHEMICAL FLOCCULABILITY OF SLUDGE ORGANISMS IN RESPONSE TO GROWTH CONDITIONS,
Pittsburgh Univ., PA. Dept. of Civil and Environmental Engineering.
Y. C. Wu.
Biotechnology and Bioengineering, Vol. 20, No. 5, p 677-696, 1978. 10 fig, 4 tab, 19 ref.

Descriptors: *Flocculation, *Nutrients, *Deficient elements, *Activated sludge, *Cytological studies, Neutralization, Chemical precipitation, Phosphorus, Nitrogen, Nutrient removal, Settling velocity, Waste water treatment, Municipal wastes.

The influence of nutrient deficient wastes on alum flocculation of sludge organisms was evaluated in an activated sludge system without cellular recycle. Microbial samples were cultivated in a continuous-flow activated sludge reactor at 25C, using a hydraulic retention time of 4.5 hrs and an aeration rate of 2,000 ml/min/liter. Cell capsule formation occurred under phosphorus and nitrogen limitation; capsules were throught to be negatively-charged polymers when formed in neutral conditions. While the unit cell surface charge was not influenced by low nutrient restrictions, it increased significantly when COD:N and COD:P ratios increased above 34:1 and 290:1, respectively. This phenomenon was attributed to increased capsule material accumulation. Biological solids productions, bacterial cell surface properties, and residual and soluble P content in the culture media were controlled by the influent feed concentrations of N and P; these conditions, in turn, directly affected the chemical flocculation efficiency of the system. Higher alum doses were required to flocculate nutrient-starved dispersed microorgan-

isms because of the higher unit cell surface charge and resistance to charge neutralization. The ratio of alum-to-phosphorus for 90% phosphorus remova was higher than the stoichiometric relationship of these substances at equilibrium; an alum-to-phosphorus ratio of 1.17:1-2.0:1 was required to produce effluent soluble phosphorus concentrations of 6.68-9.03 mg/liter. Sludge settling velocity increased with increasing nutrient concentrations in the feed. (Lisk-FIRL)
W78-09391

CO-DISPOSAL OF SEWAGE SLUDGE USING REFUSE-DERIVED FUEL,
Clinton Bogert Associates, Fort Lee, NJ.
For primary bibliographic entry see Field 5E.
W78-09392

LIME/SODIUM BICARBONATE TREATMENT INCREASES SLUDGE DIGESTER EFFICIENCY,
Church and Dwight Co., Inc., Piscataway, NJ.
N. R. Barber.
Journal of Environmental Sciences, Vol. 21, No. 2, p 28-30, 1978. 2 fig, 1 tab, 4 ref.

Descriptors: *Anaerobic digestion, *Lime, *Sodium compounds, *Methane bacteria, *Alkalinity, Carbon dioxide, Cations, Methane, Sewage sludge, Microbial degradation, Waste water treatment, Calcium carbonate, Municipal wastes, Acid bacteria.

Combined lime and sodium bicarbonate treatment of sewage sludge during anaerobic digestion is evaluated. Methane-forming bacteria require a pH of 6.8-7.2 for optimum methane generation; neutrality is maintained by chemical treatment of the sludge to counteract the effect of acid-forming bacteria. When added to the digester to raise the pH, lime reacts with CO2 and can cause a vacuum to form at different CO2 partial pressures. In imbalanced digesters, the vacuum potential increases and air may flow into the digester with toxic effects on the methane-forming bacteria. Excess lime addition in the presence of CO2 can form insoluble calcium carbonate which will not increase alkalinity. The use of lime and sodium carbonate in anaerobic digestion reduces the toxicity of divalent cations. The combined treatment also reduces the presence of high pH patches in the sludge liquor. It is recommended that lime be added initially to increase the pH to 6.3-6.5, followed by sodium bicarbonate to increase pH to the optimum 6.5-7.2. The chemicals are added to maintain a digester alkalinity of 2,500-5,000 mg/liter as CaCO3 and a volatile acid concentration of 300-500 mg/liter as acetic acid. Sodium bicarbonate additions of 500 mg/liter/day will maintain a sodium concentration of 137 mg/liter; additions of 1,500 lb sodium bicarbonate/1 million gal influent sludge will increase bicarbonate alkalinity by 180 mg/liter when digester alkalinity falls below 2,500 mg/liter. (Lisk-FIRL)
W78-09393

THE COMPARISON OF ACTIVATED AND DIGESTED SLUDGE APPLIED TO FLOWERING CHINESE CABBAGE, BRASSICA PARACHINESIS BAILEY,
Chinese Univ. of Hong Kong. Dept. of Biology.
For primary bibliographic entry see Field 5E.
W78-09394

RECLAIMED SEWAGE WATER: A HYDROPONIC GROWTH MEDIUM FOR PLANTS,
California Univ., Los Angeles.
For primary bibliographic entry see Field 5E.
W78-09395

LAND TREATMENT: PRESENT STATUS, FUTURE PROSPECTS,
Metcalf and Eddy, Inc., Palo Alto, CA.
For primary bibliographic entry see Field 5E.
W78-09396

AUTOMATIC CONTROL OF A DIFFUSED AIR TREATMENT PLANT,
B. L. Thurley.
Brown Boveri Review, Vol. 64, No. 11, p 693-698, November, 1977. 6 fig.

Descriptors: *Instrumentation, *Measurement, *Analog models, *Digital computers, *Automation, Monitoring, Aeration, Settling basins, Dissolved oxygen, Sewage sludge, Analytical techniques, Waste water treatment, Treatment facilities, Municipal wastes.

Automatic monitoring and control systems are described for diffused air aeration waste water treatment facilities. Debris buildup on the raking screens and sludge accumulation in the digester can be monitored by Deltapi E transmitter with air fed Pneumerstats; data can be displayed on a milliammeter indicator and computing bin. Venturi flume throat constricters in grit channels are employed as flowmeters when connected to a Lea series A recorder or transmitter. This series can be used to control a penstock for maintaining appropriate flows. Sediment removal from the primary settling tanks, final sedimentation tanks, and storm tanks is controlled by ultrasonic sludge level detectors. A Veriflux magnetic flowmeter, connected to a Flexel LB-52 flow controllers, and a computing bin maintain the flow of air in the diffused aeration system. Activated sludge return is measured by the Veriflux meter; Simplex high-intensity aeration cones control the aeration intensity by varying the rotational speed. Mackereth lead anodes, surrounded by a cathode contained in a semipermeable polyethylene membrane, monitor the dissolved oxygen content of the effluent. Kent Deltapi E transmitters are also used to measure gas pressures in the digesters. Analog displays can be connected to digital telemetry systems for data collections in large plants. (Lisk-FIRL)
W78-09397

BUBBLE POWER CUTS SEWAGE PLANT ENERGY USE.
Engineering News-Record, Vol. 200, No. 17, p 16, April, 1978.

Descriptors: *Biological treatment, *Activated sludge, *Aeration, *Rotational flow, *Plastics, Construction materials, Design data, Biodegradation, Bubbles, Waste water treatment, Financing, Treatment facilities, Municipal wastes.

Polyethylene biological contact cylinders, installed in Philadelphia, Pennsylvania's Northeast waste water treatment plant, may receive additional government funding as an innovative design. The 190 mgd treatment plant installed 22 surfact units, each 25 ft long with a 12 ft diameter, providing a total of 2.2 million sq ft of surface area. The honeycombed cylinders contain angled cups which catch the air from the aeration bays, causing the cylinders to rotate at about 0.8 rpm without a power source. An estimated $850,000/year will be saved in power costs with the biological treatment system, which also reportedly increases the activated sludge process efficiency. The surfact system is expected to provide an additional 28% of the costs of upgrading the secondary treatment plant to 250 mgd. The city may receive an additional 10% funding for the $160 million project as an incentive for designing innovative sewage treatment techniques. (Lisk-FIRL)
W78-09398

AUTOMATIC CONTROLS PREVENT CHLORINE SPILL HAZARDS,
H. Last.
American City and County, Vol. 93, No. 5, p 89-90, May, 1978. 1 fig.

Descriptors: *Chlorine, *Instrumentation, *Leakage, *Monitoring, *Neutralization, Gases, Air pollution, Automatic control, Chlorination, Treatment facilities, Air circulation, Municipal wastes.

A chlorine scrubbing system installed in the Tonawanda, New York, waste water treatment plant chemically neutralizes chlorine spills automatically. The system contains five chlorine detectors installed at floor level in the chlorine storage room and chlorine feed room to seal off the rooms and stop the ventilation system when chlorine is detected in the air. An alarm is activated and the scrubbing system pumps create a draft to circulate the chlorine contaminated air through one or more of the three ejector venturi scrubbers. The chlorine is neutralized with caustic sodium hydroxide solution in the venturi scrubbers and neutralized air is recirculated through mist eliminators to the room where the leak originated. The scrubbing system continues to operate until the chlorine content in the air is reduced to 1 ppm. The use of caustic soda does not significantly change the character of the treatment plant effluent which is discharged into the Niagara River. (Lisk-FIRL)
W78-09399

SIMULTANEOUS DETERMINATION OF TRACE METALS IN INDUSTRIAL AND DOMESTIC EFFLUENTS BY DIFFERENTIAL PULSE ANODIC STRIPPING VOLTAMMETRY,
Benedict Coll., Columbia, SC. Dept. of Chemistry.
For primary bibliographic entry see Field 5A.
W78-09400

FEED YOUR PLANT LIQUID FERTILIZER,
Bryant-Curington, Inc., Austin, TX.
D. R. Brosman.
Water and Wastes Engineering, Vol. 15, No. 5, p 89, 96, May, 1978.

Descriptors: *Textiles, *Fertilizers, *Nutrients, *Activated sludge, *Nitrogen, Phosphorus, Ammonium compounds, Phosphorus compounds, Plastic pipe, Waste water treatment, Industrial wastes.

The conversion of textile waste treatment facilities to extended aeration-activated sludge treatment required nutrient additions in the form of liquid fertilizer. Studies of effluent from the 3 mgd plant at Mission Valley Mills, Inc., in New Braunfels, Texas, revealed the need for an additional 100 lbs/day nitrogen and 20 lbs/day phosphorus to activated sludge effluent. Preliminary studies indicated that anhydrous nitrogen would cost $0.20/lb and phosphoric acid would cost $24.31/100 lb. Liquid fertilizer, added at a rate of 500 lbs/day with an Nip ratio of 20:8, cost about $166/ton, based on 1977 costs. An estimated annual savings of $4,887.35 has been realized with liquid fertilizer doses costing $29/day, as opposed to $42.39/day for separate nutrient additions. The fertilizer, with a nearly netural pH, is added at a rate of about 11 lbs/gal. A polyvinyl chloride feed pipe delivers the liquid fertilizer to the aeration basin from a 6,400 gal steel storage tank via a chemical feed pump. The liquid fertilizer does not affect carbon steel, stainless steel, and polyvinyl chloride, but can corrode brass and aluminum; nutrient addition can be adjusted to accommodate BOD variations. (Lisk-FIRL)
W78-09401

PURIFICATION OF WASTE WATER--CONTAINJNG ORGANIC WASTE INCLUDES TREATMENT WITH MIXTURE OF A SILICA GEL AND CELLULOSE,
Soviet Patent SU-290-694. Issued April 28, 1978.
Derwent Soviet Inventions Illustrated, Vol. A, No. 7, p 2-3, 1978.

Descriptors: *Organic wastes, *Patents, *Cellulose, *Silica, *Gels, Ureas, Ammonia, Lipids, Filtration, Waste water treatment, Sewage bacteria, Oxygen demand, Municipal wastes.

A patented process to reduce oxygen demand and pathogenic bacteria in waste water employs Cellogel paste, a mixture of silica gel and cellulose. The Cellogel is mixed with 20 ml of water and added to waste water containing organic wastes such as fatty acids, urea, and ammonia. About 58G of Cellogel is added for each liter of waste water containing an oxygen demand of 2,175-4,360 mg/liter. After the paste is added, the effluent mixture is clarified and filtered. The final effluent has an average oxygen demand of 150-112 mg/liter; staphyloccoccus bacterial counts of 680,000 may be reduced by 100% after 45 min of contact with Cellogel. The Cellogel treatment process is especially suitable for closed cycle life support systems. (Lisk-FIRL).
W78-09403

THE BACTERIAL METABOLISM OF 4,4'-DICHLOROBIPHENYL, AND ITS SUPPRESSION BY ALTERNATIVE CARBON SOURCES,
Amsterdam Univ., (Netherlands). Lab. of Environmental and Toxicological Chemistry.
M. T. M. Tulp, R. Schmitz, and O. Hutzinger.
Chemosphere, Vol. 7, No. 1, p 103-108, 1978. 2 fig, 26 ref.

Descriptors: *Sewage bacteria, *Polychlorinated biphenyls, *Activated sludge, *Metabolism, *Analytical techniques, Chlorination, Biodegradation, Soils, Bacteria, Gas chromatography, Mass spectrometry, Organic compounds, Path of pollutants, Waste water treatment.

Gas chromatography-mass spectrometry (GC-MS) was used in experiments to examine the metabolism of 4,4'-dichlorobiphenyl by activated sludge bacteria. In shake culture studies, 50 ppm of the test compound, dissolved in ether, was added to vessels containing an inoculum of sludge supernatant. D-glucose, glycerol, peptone, yeast extract, and humic acid were used as alternate carbon sources for an unsedimented activated sludge inoculum. In soil studies, the test compound was continuously filtered through an inoculated column contaning garden soil and coarse sand. The metabolites were isolated at the termination of the experiments by acidification with H_2SO_4, hydrolysis, three ether extractions, and centrifugation. Retention times and relative intensities during GC-MS revealed that 4-chlorobenzoic acid and 4,4'-dichloro-2,3- biphenyldiol were the major byproducts of 4,4'-dichlorobiphenyl metabolism. The formation of these metabolites by the mixed bacterial populations in the activated sludge cultures was suppressed to below detection limits when alternate carbon sources were made available. No metabolites were detected in similar experiments with higher chlorinated isomers, including 2,4',5-tri-,2,2',5,5'-tetra-, 2,2',3,4,5'-penta-, 2,2',3,4,5,5'-hexa-, and decachlorobiphenyl. (Schulz-FIRL)
W78-09404

QUANTITATIVE ANALYSIS OF HYDROCARBONS IN SEWAGE SLUDGE FROM WASTE WATER PURIFICATION STATIONS,
Institut d'Hygiene, Geneva (Switzerland). Service o. xicologie Industrielle, d'Analyse de l'Air et de Protection Center le Bruit.
For primary bibliographic entry see Field 5A.
W78-09407

RECOVERY OF ASCARIS EGGS FROM SLUDGE,
Cincinnati Univ., OH. Dept. of Biological Sciences.
For primary bibliographic entry see Field 5A.
W78-09408

PRACTICAL METHOD FOR DETECTING POLIOVIRUS IN ANAEROBIC DIGESTER SLUDGE,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Science and Engineering.
For primary bibliographic entry see Field 5A.
W78-09409

DESIGN OF DRYING BEDS FOR SURPLUS ACTIVATED SLUDGE,
P. B. B. Vosloo.
Water Pollution Control, Vol. 77, No. 1, p 71-74, 1978. 1 fig, 2 ref.

Descriptors: *Activated sludge, *Drying, *Settling basins, *Separation techniques, *Hydrologic systems, Sludge treatment, Sludge disposal, Valves, Drainage, Weirs, Overflow, Sands, Filtration, Waste water treatment, Municipal wastes.

An excess activated sludge drying bed was designed to act as both a settling tank and a drying bed. The settling/drying bed contains a 200-250 mm deep layer of fine, ungraded sand that may be obtained from the construction site. The rectangular bed has one end wall, opposite the sludge inlet, that acts as an overflow weir rising 300 mm above the sand level. A 150-300 mm wide channel runs between this weir and another located upstream; the channel is divided into 5 sections with drainage means 500 mm below the sand level, connecting to the main overflow weir which discharges into a downstream collecting trough. The drainage valves within the troughs are closed when the mixed liquor is introduced. Water in excess of the bed capacity spills over the main weir into the collection trough as sludge settles to a 100-200 mm thickness. The surface water is drained sequentially through the trough valves serving the 5 sections of the upstream weir at heights above the sand level of 75, 120, 165, 210, and 255 mm. Liquid that is not drained from the surface filters through the sand bed and the sludge layer is allowed to evaporate. The design application rate is 1.5 kgk/sq m with an excess activated sludge drying time of 4 days. (Lisk-FIRL)
W78-09410

AUTOTHERMAL THERMOPHILIC AEROBIC DIGESTION,
Union Carbide Corp., Tonawanda, NY. Linde Div.
M. S. Gould, and R. F. Drnevich.
Journal of the Environmental Engineering Division-ASCE, Vol. 104, No. EE2, p 259-270, April, 1978. 3 fig, 2 tab, 7 ref, 1 append.

Descriptors: *Digestion, *Sludge digestion, *Aerobic conditions, *Aeration, *Oxygen requirements, Mass transfer, Dissolved oxygen, Heat balance, Sewage bacteria, Pilot plants, Model studies, Salmonella, Waste water treatment, Municipal wastes.

Autothermal thermophilic aerobic digestion with high purity oxygen acration of sewage sludge was evaluated in pilot plant studies. Based on a stoichiometric oxygen-to-volatile solids ratio of 1.50, the heat generation coefficient was estimated as 9.150 BTU/lb oxidized volatile solids. Cell synthesis contributed to a higher net oxygen requirement of 1.6-1.8 lb oxygen/lb oxidized volatile solids. Oxygen acration during the thermophilic operation increased the oxygen saturation of the system and significantly enhanced mass transfer with less acration power input than air systems. Digestion systems and the pilot plant study utilized a two-stage operation in which heating was limited to the first stage with mass transfer heating of the second stage. An air aeration system was unable to attain thermophilic digestion without supplementary heat, was mass transfer limiting, and was unable to operate efficiently at high solids loading. An autothermal thermophilic digester with oxygen acration was operated in the first stage at temperatures exceeding 50C over a period of 1.4-2.3 days. Heat leaks and reduced mass transfer to the second stage necessitated insulation of the pilot plant. Volatile solids were reduced by 30-40% in the first stage at retention times of 1.4-2.3 days, with overall reductions of about 80%. The pilot plant operation reduced salmonellae and Pseudomonas acruginosa to below detection limits. (Lisk-FIRL)
W78-09411

BIOLOGICAL FILTRATION THROUGH A PACKED-COLUMN,
Montpellier-2 Univ (France). Lab. de Genie Chemique, Traitement et Epuration des Eaux.
S. Elmaleh, H. Labaquere, and R. Ben Aim.
Water Research, Vol. 12, No. 1, p 41-46, 1978. 6 fig, 5 ref.

Descriptors: *Columns, *Mathematical models, *Porosity, *Water purification, *Oxygen requirements, Biological treatment, Packed beds, Filtration, Porous media, Nutrient removal, Laboratory tests, Model studies, Performance, Permeability, Biodegradation, Waste water treatment, Municipal wastes.

Mathematical models predicting porosity decrease, oxygen depletion, and purification efficiency in a packed column during biological filtration of waste water were tested in a laboratory column reactor packed with crushed brick and fed with a dissolved substrate. Porosity decrease is calculated from initial porosity of the packed column which is diminished by the ratio of initial biomass concentration to density as a partial product of the specific growth rate to oxygen transfer coefficient ratio minus the growth yield rate with respect to the specific growth rate and time. Oxygen depletion is determined as a function of influent oxygen concentration, the oxygen transfer coefficient according to the filtration velocity, the specific area, porosity, and the initial biomass concentration with respect to the specific growth rate and time. Purification efficiency is taken as the product of the height of column efficiency at a specific growth rate and time and the ratio of specific growth rate and initial biomass concenttration to filtration velocity and initial substrate concentration. Performance predictions calculated from these design parameters agreed with data obtained with the laboratory packed column. Although certain assumptions in the models are oversimplified, the models are considered accurate enough for laboratory tests of filter designs. (Lisk-FIRL)
W78-09412

ENSURING CLARITY AND ACCURACY IN TORQUE DETERMINATIONS,
For primary bibliographic entry see Field 8C.
W78-09413

FACTORS INFLUENCING LOW SPEED SURFACE AERATION SELECTION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
H. H. Sherrard.
Water and Sewage Works, Vol. 125, No. 2, p 32-35, February, 1978. 3 fig, 4 tab, 5 ref.

Descriptors: *Aeration, *Mathematical models, *Kinetics, *Hydraulic systems, *Hydraulic equipment, Nitrification, Biochemical oxygen demand, Equations, Nitrogen, Aerated lagoons, Waste water treatment, Municipal wastes.

Parameters influencing the selection of low speed surface aerators are reviewed for activated sludge systems in which the kinetic coefficients for BOD and nitrification are known. Oxygen demands under different conditions are calculated from waste water treatability and subsequent biokinetic coefficients. From these values, sludge age is calculated for use in determining balanced biochemical stoichiometrical equations to predict oxygen

demand by microorganisms. Stoichiometric equations are developed for calculating influent waste water BOD and total Kjeldahl nitrogen (TKN) concentrations, removal efficiencies of BOD and TKN, sludge production related to time, and the variable yield coefficient. The overall mass transfer coefficient under aerator design conditions is calculated for selecting the aerator shaft horsepower in conjunction with a nomograph. The mathematical models are applied to conditions in a 1 mgd waste water treatment facility treating effluent with BOD levels of 350 mg/liter. The results of the model studies demonstrate that greater horsepower capacities are required for tanks with larger aeration volumes, higher values of hydraulic retention time, and higher concentrations of TKN. (Lisk-FIRL)
W78-09414

CALCULATION AND COMPARISON OF ACTIVATED SLUDGE BASINS AS CONTINUOUS STIRRED TANK OR PLUG FLOW REACTORS,
Technische Univ., Berlin, (West Germany). Inst. fuer Chemicingenieurtechnik.
A. Mehring, and U. Wiesmann.
German Chemical Engineering, Vol. 1, No. 1, p 31-38, 1978. 11 fig, 2 tab, 29 ref.

Descriptors: *Activated sludge, *Mathematical models, *Kinetics, *Equations, *Sewage sludge, Analytical techniques, Theoretical analysis, Model studies, Design criteria, Waste water treatment, Municipal wastes.

A theoretical analysis of continuous activated sludge reactors operated as completely mixed continuous stirred tanks (CST) or as plug flow reactors (PF) without back-mixing considered the performance of reactors and their limiting conditions. The maximum recycle ratio was calculated as a function of the sludge recycle, thickening, and outlet ratios derived from the microorganism balance. Equations were developed for the dimensionless concentration of the substrate and of the microorganisms at the reactor inlet, the balance of substrates and microorganisms in dimensionless form, and the dimensionless substrate concentration at the outlet. The dimensionless mean cell residence time was derived as a function of assumed values of substrate concentration and recycle ratio. Significant fractional conversion was observed only after a specific mean residence time was exceeded. Application of the equations to PF and CST reactors with sludge recycle assumed a constant oxygen concentration in an isothermal and steady-state process. The results indicated that a higher minimum mean residence time was required by the PF reactor to avoid washout of the bacterial culture; PF reactors provided higher fractional conversion. With lower residence times and fractional conversion, the CST reactor was considered superior. (Lisk-FIRL)
W78-09415

LAB STUDY HELPS SOLVE AEROBIC DIGESTER PROBLEMS,
Colorado Univ., Boulder. Dept. of Civil, Environmental, and Architectural Engineering.
L. Benefield, R. Seyfarth, and A. Shindala.
Water and Sewage Works, Vol. 125, Reference Number, p R-60, R-62-64, R-66-68, R-70, 1978. 20 fig, 13 ref.

Descriptors: *Aerobic conditions, *Sludge digestion, *Laboratory tests, *Temperature, *Design data, Model studies, Chemical oxygen demand, Oxygen requirements, Nitrates, Suspended solids, Waste water treatment, Municipal wastes.

Laboratory batch and continuous flow digesters were made to compare solids destruction rate coefficients, oxygen demand, and supernatant characteristics under temperature variations in studies to develop design parameters for continuous flow aerobic digesters. Acclimated sludge was digested on a batch feed mode at temperatures of 30, 40, and 50C with aeration for 15 days. COD, nitrate, orthophosphate, oxygen uptake, and volatile suspended solids were measured after 5, 10, and 15 days of aeration. Similar conditions were maintained in continuous feed digesters; waste sludge was replaced daily with batch feed sludge for aeration times of 5, 10, and 15 days. Analyses were conducted over 7 days, after steady-state was reached. The modified Arrhenius relationship for calculating the reaction rate constant for volatile suspended solids degradation was not applicable to the temperature variations employed in the study. Specific oxygen uptake rates were highest in the continuous feed digester maintained at 30C, lowest at 40C, and constant between 5-15 days in all continuous digesters. COD values in batch and continuous digesters were significantly different; the highest COD levels in continuous digesters were observed at 50C. Little variation in nitrate and orthophosphate levels in the batch and continuous digesters was apparent; nitrifying bacteria were sustained in the 40C continuous digester but not in the 40C batch digester. (Lisk-FIRL)
W78-09416

RESPONSE OF ACTIVATED SLUDGE PROCESSES TO ORGANIC TRANSIENTS-KINETICS,
Los Angeles County Sanitation Districts, Whittier, CA.
M. W. Selna, and E. D. Schroeder.
Journal Water Pollution Control Federation, Vol. 50, No. 5, p 944-956, May, 1978. 15 fig, 3 tab, 21 ref.

Descriptors: *Activated sludge, *Kinetics, *Model studies, *Organic loading, *Chemical oxygen demand, Mathematical models, Sewage sludge, Settling velocity, Analytical technique, Waste water treatment, Unsteady flow, Municipal wastes.

The impact of square-wave transient loading variations, 2-7 times the steady-state organic levels, on growth rates, substrate utilization rates, and settling rates was investigated using mixed liquor from an activated sludge reactor. Mean cell residence time ranged over 5.5-11.5 days, with hydraulic residence times in the aeration tank of 6.0-6.9 hrs. Transient loading was accomplished by increasing the steady-state COD of 265 mg/liter to 520-1,950 mg COD/liter. The Monod equation adequately described the results when applied before step-down and when soluble effluent COD calculations were modified. Transient loading variations did not significantly affect suspended solids concentrations of sludges which initially had good settling properties; large deviations in growth rates and organic removal rates were observed. Soluble effluent COD increased significantly with square-wave transient loadings at four times the steady-state parameters. Results of the study indicated that effluent COD could be controlled by regulating steady-state unit growth rates as an inverse function of mean cell residence time; a 5-day mean cell residence time did not adversely affect substrate utilization. (Lisk-FIRL)
W78-09417

UTILIZING STOICHIOMETRY FOR DENITRIFICATION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
J. H. Sherrard, and R. Sivasubramanian.
Water and Sewage Works, Vol. 125, No. 6, p 104-106, 108, June, 1978. 5 fig, 2 tab, 12 ref.

Descriptors: *Denitrification, *Alcohols, *Mathematical models, *Nitrates, *Biomass, Chemical reactions, Analytical techniques, Equations, Kinetics, Anaerobic digestion, Nitrogen, Waste water treatment, Municipal wastes.

Balanced stoichiometric equations were used to calculate methanol additions and waste sludge production for denitrification of waste water under anaerobic conditions. Formulas were derived for predicting methanol requirements, biomass production, effluent waste concentration, waste treatment efficiency, sludge protection, and variable cell yield coefficients. Utilizing predetermined kinetic coefficients of denitrification at 10, 20, and 30C and an influent nitrate-nitrogen concentration of 14 mg/liter, the kinetic equations were solved for a selected initial methanol concentration; solutions were utilized to develop a stoichiometric equation for denitrification. From this balanced equation, methanol doses at various mean cell retentions times and temperatures were calculated as a function of observed cell yield coefficients. The study determined that methanol requirements for denitrification decreased with increasing mean cell retention time and increased with increasing temperature. Waste sludge production increased with shorter mean cell retention times and higher temperatures. Higher methanol doses were required for higher influent concentrations of nitrate-nitrogen and dissolved oxygen. (Lisk-FIRL)
W78-09418

CONTROLLING IMPOUNDMENTS WHICH MAY POLLUTE GROUNDWATER,
Maryland Water Resources Commission, Annapolis. Permits Div.
For primary bibliographic entry see Field 5G.
W78-09419

THE EFFECTS OF MADISON METROPOLITAN WASTEWATER EFFLUENT ON WATER QUALITY IN BADFISH CREEK, YAHARA AND ROCK RIVERS,
Texas Univ., Dallas.
For primary bibliographic entry see Field 5C.
W78-09422

REUSE, ENERGY, SLUDGE: IN WHAT DIRECTION ARE WE GOING,
L. Greifer.
Water and Wastes Engineering, Vol. 15, No. 1, p 37-38, 40, 42-44, January, 1978.

Descriptors: *Treatment facilities, *Pilot plants, *Irrigation practices, *Return flow, *Incineration, Ultimate disposal, Viruses, Ammonia, Disinfection, Chlorination, Groundwater recharge, Injection, Energy sludge digestion, Sludge disposal, Sludge treatment, Waste water treatment, Municipal wastes.

Pilot plant studies and current waste water treatment practices are reviewed for the reuse of waste water and energy generation from sludge disposal techniques. The Odessa, Texas, sewage treatment plant discharges its wastes to a secondary treatment facility in a petrochemical plant which uses the treated water as cooling tower makeup and boiler feed water; the petrochemical wastes are recharged into injection wells for oil production. An Israeli pilot plant recharges the waste water into potable aquifers after oxidation lagooning, lime conditioning, clarification and chlorination; the recharged water is used for irrigational and industrial purposes but also fulfills potable water standards. Autothermic copyrolysis of sewage sludge and refuse-derived rather than fossil fuel required a fuel-to-sludge ratio of 1:2 and a sludge solids content of 24%. Orange County, California, has utilized digester gas and waste heat from secondary treatment operations with a fuel value of 600 BTU/cu ft as a power supply. A comparison of pyrolysis and incineration in Arlington County, Virginia, indicated that pyrolysis required lower temperatures and less combustion air, while producting enough steam to power the afterburner. Pyrolysis in conjunction with activated carbon reduced suspended solids by 95%, grease to 10 mg/liter, BOD above 30 mg/liter, and heavy metals by 75.0-99.9%. Co-incineration of sludge and refuse produced 150,000 kilowatt hrs/day of power. Viruses in sludge supernatant were disin-

fected within 3 days at 35C. Land application, pH adjustment, and ocean disposal of sewage sludge were also reviewed. (Lisk-FIRL)
W78-09423

WATER REORGANIZATION--AIMS, ACHIEVEMENT AND THE FUTURE,
Thames Water Authority, London (England).
For primary bibliographic entry see Field 5G.
W78-09424

PROCESS AND SYSTEM FOR ANAEROBIC TREATMENT OF BIOCHEMICAL WASTE,
Hitachi, Ltd. (Japan). (Assignee).
M. Ishida, R. Haga, and Y. Odawara.
U.S. Patent No. 4,067,801, 11 p, 4 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 966, No. 2, p 667, January 10, 1978.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Anaerobic digestion, Activated sludge, Separation techniques, Methane fermentation, Acid fermentation, Biochemical wastes.

In a system for treatment of biochemical waste such as activated sludges, the waste is subjected to anaerobic stabilization processes, which include two phases of an acid fermentation and a methane fermentation effected in separate reactors. The waste after the acid fermentation is then separated into a liquid effluent for the methane fermentation and a waste sludge. The waste sludge which may cause secondary environmental pollution is re-treated within the anaerobic stabilization processes without withdrawing from the system. It is preferable to recover the cells of acid formers from the waste after the acid fermentation in order to enhance the efficiency of the stabilization. (Sinha-OEIS)
W78-09426

EXTRACTION OF FERTILIZER SALTS AND ORGANIC SUBSTANCES OF HIGH NUTRITIVE VALUE FROM INDUSTRIAL WASTE WATERS,
Reggiane Officine Meccaniche Italiane S.p.A., Milan (Italy). (Assignee).
P. Baldassari.
U.S. Patent No. 4,069,033, 5 p, 1 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 966, No. 3, p 1080, January 17, 1978.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Dissolved solids, Organic wastes, Fertilizers, Food processing industry, Separation techniques, Usable waste products, Fodder additives.

The known treatments of waste water refer mainly to the depuration of these waste waters and less to the problem of the recovery of useful substances contained in them. The principal object of this invention is to permit the separation of high Totally Dissolved Solids (TDS) content waste waters from low TDS content waste waters, the latter being then treated with conventional biological methods, while the high TDS content waste waters are subjected to a series of successive operations allowing end products such as organic concentrates to be used as additives for fodder and fertilizing salts to be obtained. The process includes the following operating phases: Automatic diversion of high TDS content waste waters from those of low TDS content by means of a conductivity or density measuring instrument; mixing high TDS content with strong acids or bases to form stable salts; filtration of the solution to eliminate the insoluble substances; concentration of the solution by means of evaporation; crystallization of the concentrated solution; and separation by means of centrifugation of the fertilizer salts from the mother liquors containing organic substances of high nutritive value. (Sinha-OEIS)
W78-09431

PURIFICATION APPARATUS FOR WATER PURIFICATION AND PURIFICATION SYSTEM THEREFOR,
Transportbeton-Beratungs-Gesellschaft mit beschrankter Haftung, Ratingen (West Germany). (Assignee).
B. Friesenborg, and H. Eberhardt.
U.S. Patent No. 4,069,143, 13 p, 9 fig, 7 ref; Official Gazette of the United States Patent Office, Vol 966, No 3, p 1112, January 17, 1978.

Descriptors: *Patents, *Waste water treatment, *Water purification, *Water pollution treatment, Industrial wastes, Separation techniques, Suspended solids, Cements, Limestones, Alkaline water, Recycling.

A purification apparatus for water purification with a settling device for sediment comprises a settling vessel and a separate sediment container, which for the purification, sand open in communicative connection with each other in the assembled condition and are sealed tightly in the connection plane toward the outside by a seal, and for exchange of the sediment the containers are constructed moveable relative to each other. The settling vessel is supported with a roller wagon on running rails and has longitudinally variable supports which each comprises a telescopic tube with a spring arranged in it. A purification system includes a separation device and a collection vessel in inlet and outlet communication, respectively, with the settling vessel, the separation device including a vibrating screen, a supply line entering the settling vessel, and a purge from the collection vessel spraying water on the screen. The system has the advantage that the accumulating wastes are considerably reduced since the granular additives and the alkaline waste water can again be fed back into the circuit course. (Sinha - OEIS)
W78-09432

WASTE WATER TREATMENT WITH OXYGEN,
Chemetron Corp., Chicago, IL. (Assignee).
E. Abrams, and A. J. Masella.
U.S. Patent No. 4,069,147, 12 p, 2 fig, 1 tab, 9 ref; Official Gazette of the United States Patent Office, Vol. 966, No. 3, p 1114, January 17, 1978.

Descriptors: *Patents, *Waste water treatment, Organic wastes, *Water pollution treatment, Activated sludge, Oxygen, Biodegradation, Aerobic bacteria, Absorption, Aeration, *Oxygenation(Biological).

The organic pollutants in a waste water stream can be reduced 90-95% by providing oxygen to sludge organisms for biological oxygenation of the pollutants. The raw waste water and activated organisms (sludge containing little or no pollutants) are mixed in a vessel for less than 30 minutes. In this vessel, the organisms absorb and adsorb 90-95% of the organic pollutants present in the influent raw waste water. Any means for gentle agitation can be used in this vessel. The waste-enriched organisms are separated from the supernatant liquid in a clarifier and sent to an oxygenation vessel where the organisms metabolize the waste by treatment with an oxygen-containing gas having at least 30% by volume oxygen. The thus-activated organisms are returned to the mixed liquor vessel to complete the cycle. (Sinha-OEIS)
W78-09433

INDUSTRIAL WASTE WATER TREATMENT PROCESS,
Du Pont de Nemour (E. I.) and Co., Wilmington, DE. (Assignee).
D. G. Hutton, and F. L. Robertaccio.
U.S. Patent No. 4,069,148, 8 p, 1 fig, 6 tab, 14 ref; Official Gazette of the United States Patent Office, Vol. 966, No. 3, p 1114, January 17, 1978.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution treatment, Biological treatment, Activated carbon, Oxygen, Biochemical oxygen demand, Chemical oxygen demand.

Industrial waste water, containing impurities which poison or otherwise inhibit bacterial forms employed in biological treatment of waste water, is purified by a process which comprises subjecting the waste water to a biological treatment process in the presence of activated carbon or fuller's earth. A gas containing molecular oxygen is distributed within the liquid mixture during treatment to provide oxidation means. Despite the presence of the poisonous or inhibiting impurities, the process efficiently reduces the biochemical oxygen demand, chemical oxygen demand and total organic content of the waste water in an unusually rapid manner, and removes material not normally removed by the biological treatment alone. This process can be employed with industrial waste water alone or with mixtures of industrial waste water and sewage or other waste water. (Sinha-OEIS)
W78-09434

SEWAGE TREATMENT SYSTEM,
Ecodyne Corp., Chicago, IL. (Assignee).
D. G. Mason.
U.S. Patent No. 4,069,156, 7 p, 3 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 966, No. 3, p 1116, January 17, 1978.

Descriptors: *Patents, *Waste water treatment, *Sewage treatment, *Water pollution treatment, Biodegradation, Microbial degradation, Aeration, Anaerobic digestion, Denitrification, Equipment.

A method and apparatus for the treatment of sewage is described in which effluent containing biodegradable wastes is first delivered to a clarification zone, and is held in the clarification zone for a time period sufficient to permit suspended solids to settle to the bottom of the zone. It is then delivered from the clarification zone to an oxidation/nitrification zone, where it is aerated and passed through a bed of submerged media w hich comprises a multiplicity of elements freely and randomly stacked on one another to provide interstitial area between them. The elements have a high surface area to volume ratio in order to promote the growth of aerobic microorganisms on their surface. The effluent is then delivered from the nitrification zone to a denitrification zone, where it is passed through another bed of submerged media. A carbon-containing nutrient is fed to the microorganisms to promote the anaerobic growth of the microorganisms on the media and to promote the digestion of materials. Basically, the apparatus comprises a multiplicity of zones including a clarification zone, an oxidation/nitrification zone, and a denitrification zone. (Sinha-OEIS)
W78-09436

PROCESS RELATED TO PULP BLEACHING EFFLUENT PURIFICATION USING ION EXCHANGE RESINS,
Uddeholms A. B. Hagfors (Sweden). (Assignee).
L-G. Anderson, H. R. Andersson, B. G. Broddevall, and A. Lindberg.
U.S. Patent No. 4,070,234, 8 p, 5 fig, 3 ref; Official Gazette of the United States Patent Office, Vol. 966, No. 4, p 1477, January 24, 1978.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution treatment, Bleaching wastes, Chlorination, *Ion exchange resins, Pulp and paper industry, Counter-current washing.

A process related to pulp bleaching having a sequence comprising treatment with chlorine, extraction with alkali, and a final bleaching section which in turn may comprise a number of various bleaching stages, is described. The method is characterized in that at least a number of washing steps are connected in series counter-currentwise

from a washing step in the final bleaching section to the wash step of the first alkali extraction stage; that a strongly polluted effluent from the wash step of the first alkali extraction stage is fed through a first column containing a bed of a particulate, porous resin provided to trap (take up) and retain organic pollutants in the effluent; and that a combined effluent comprising an acidic, polluted liquor from the chlorine bleaching stage and the partly purified filtrate from the first column is fed through a second column which also contains a bed of a particulate, porous resin provided to trap organic pollutants existing in the combined effluent. The resin bed in the second column is activated by the acidic combined effluent, and chloride ions pass the resin bed without being trapped by the resin so that the chloride ions are discharged together with the purified filtrate. The purified filtrate is the final wash liquor effluent of the system. (Sinha-OEIS)
W78-09438

APPLICATION AND DETERMINATION OF ORGANIC POLYMERS,
Stevens Inst. of Tech., Hoboken, NJ.
L. K. Wang, M. H. Wang, and J. F. Kao.
Water, Air, and Soil Pollution, Vol. 9, No. 3, p 337-348, 1978. 6 fig, 67 ref.

Descriptors: *Polymers, *Polyelectrolytes, *Flocculation, *Coagulation, *Organic compounds, Anions, Cations, Sedimentation, Centrifugation, Filtration, Reverse osmosis, Flotation, Waste water treatment, Volumetric analysis, Municipal wastes.

Organic polymer applications to water and waste water are reviewed and a method to measure anionic and cationic polyelectrolytes is described. Cationic polyelectrolytes are employed as coagulants where colloids and suspended solids are negatively charged. Nonionic organic polymers are added after the onset of flocculation to agglomerate colliding particles; they can also remove phosphates when used in conjunction with ferric chloride. Anionic polymers assist in the agglomeration of negatively charged particles that have been neutralized by inorganic cations. Anionic polyelectrolytes are added as coagulation aids with alum or ferric chloride as the principle coagulants. Organic polymer treatment of waste water can enhance sedimentation, sand filtration, diatomaceous earth filtration, ultrafiltration, reverse osmosis, flotation, or centrifugation. Quantitative analysis of 0.0002-0.005 N concentrations of anionic and cationic polyelectrolytes is performed by dilute and regular direct titration with corresponding cationic and anionic titrants. Calibration curves determine the normality of cationic polyelectrolytes titrated with poly(vinyl-sulfuric acid) potassium and anionic polyelectrolytes titrated with 1,5-dmethyl-1,5-diazaundecamethylene. (Lisk-FIRL)
W78-09440

INSURING TROUBLE-FREE PUMP OPERATION,
Allis-Chalmers Corps., Milwaukee, WS. Industrial Pump Div.
For primary bibliographic entry see Field 8C.
W78-09441

CENTRIFUGE BASKET FOR SEWAGE TREATMENT SCREENS - HAS ALL-PLASTICS SEMICYLINDRICAL FRAME ELEMENTS WITH EMBEDDED SCREEN CLOTH AND GROOVE/TONGUE JOINTS AT FACE ENDS.
German Patent DS 2265-092. Issued April 13, 1978. Derwent German Patents Abstracts, Vol. A, No. 16, p 3, May, 1978.

Descriptors: *Centrifugation, *Filters, *Patents, *Filtration, *Design criteria, Joints(Connections), Screens, Plastics, Porous media, Equipment, Construction materials, Separation techniques, Waste water treatment.

A water-tight, plastic centrifuge basket to support waste water treatment filters has been patented. The plastic cage apparatus consists of a frame permanently connected to a filter grid which supports the embedded screen cloth filter medium. The frame is attached to the centrifuge unit. Plastic semi-cylindrical frame elements are mounted along the length of the cage; two or more elements are mounted in each filter cage. The elements are interconnected at both ends of the frame by tongue and groove joints that form sealed connections when in the locked position. The filter elements are disposable and prevent leakage when in use. (Lisk-FIRL)
W78-09451

BIOLOGICAL PURIFICATION PLANT FOR WASTE WATER AND SEWAGE--WITH CIRCULAR TANK DIVIDED INTO COMPARTMENTS BY VERTICAL WALLS.
French Patent FR 2354-973. Issued February 17, 1978. Derwent French Patents Abstracts, Vol. A, No. 13, p 4, May, 1978.

Descriptors: *Biological treatment, *Oxidation lagoons, *Patents, *Activated sludge, *Dewatering, Aeration, Screens, Pumps, Sludge treatment, Oily water, Waste water treatment, Municipal wastes.

A patent has been issued for a circular biological waste water treatment tank which is divided into an oxidation chamber, a decantation zone, and a sludge thickening chamber. Half of the tank provides oxidation while the other half is divided into concentric zones for decantation and sludge thickening. A bridge, spanning the top of the circular tank, provides forward and backward movement about a central axis. The bridge supports a surface aeration turbine, a porticullis-type thickener equipped with a scraper, and a rake which extends to the bottom of one of the concentric areas. Debris is initially removed from the waste water by coarse screening; grease and oil are separated out. The effluent then flows by gravity to an oxidation chamber which contains activated sludge. The oxidation chamber is connected to the decantation zone by a perforated pipe. Effluent passes through this pipe into the decantation chamber for clarification. The treated waste water is discharged to another chamber and sludge is passed to the second concentric zone for thickening. Sludge is pumped from this zone by a unit mounted on the bridge. The system simplifies shuttering construction and reduces potential blockage by reducing the need for pipe systems. (Lisk-FIRL)
W78-09462

ACTIVATED SLUDGE TRANSPORT-IN COMPACT BIOLOGICAL EFFLUENT TREATMENT PLANTS.
German Patent DS 2232-477. Issued April 6, 1978. Derwent German Patents Abstracts, Vol. A, No. 15, p 2, May, 1978.

Descriptors: *Activated sludge, *Settling basins, *Conveyance structures, *Patents, *Pumps, Biological treatment, Sludge treatment, Transport, Stabilization, Equipment, Design criteria, Waste water treatment, Municipal wastes.

An activated sludge conveyance device has been designed for compact treatment plants to minimize interference with sludge settling during operation. Scrapers mounted within the secondary sedimentation tank convey the sludge toward a suction outlet. The suction device is connected to a pump carriage which moves back and forth above a secondary sedimentation tank located near the activated sludge tank. The partition between the activated sludge tank and secondary sedimentation tank supports and guides the movement of the pump carriage. The suction pipe transports the sludge into a stabilizing chamber located in the secondary sedimentation tank. (Lisk-FIRL)
W78-09463

TREATING BADLY POLLUTED WATER BY DISINFECTION AND FLOCCULATION - ESPECIALLY USING CHLORINE, WITH SEPARATION OF SOLIDS OILS AND GREASE.
French Patent ZA 7701-432. Issued January 11, 1978. Derwent French Patents Abstracts, Vol. A, No. 12, p 2, May, 1978.

Descriptors: *Disinfection, *Flocculation, *Patents, *Oily water, *Chlorination, *Separation techniques, Aeration, Sodium compounds, Incineration, Waste water treatment, Municipal wastes.

A disinfection and flocculation process for separating solids, oils, and grease has been patented for municipal, hospital, farm, and starch manufacturing waste water treatment. The solids in the waste water are initially reduced to fine particles, homogenized, and adjusted to pH 7. Air or oxygen is then injected while the wastes are agitated, followed by disinfection with active chlorine. The waste water is transferred to a reactor where it is neutralized with aluminum sulfate and flocculated with an optional additive. The water is separated from the solids fraction and may be reused or subjected to additional thermal disinfection; sludge is removed for composting. Coarser solids are reduced to a sludge and homogenized with agitation, followed by disinfection with Ca(OH)2 and flocculation. The liquid fraction is neutralized with AlCl3 or Al2(SO3)3 to promote flocculation. (Lisk-FIRL)
W78-09464

TREATING INDUSTRIAL WASTE WATER WITH CELLULOSE CONTAINING PPTG AGENT TO REMOVE ANIONIC DYES, OPTICAL BLEACHES ETC.
Soviet Patent SU-554-806. Issued May 11, 1977. Derwent Soviet Inventions Illustrated, Vol. A, No. 17, p 1, June, 1978.

Descriptors: *Dyes, *Cellulose, *Bleaching wastes, *Patents, *Textiles, *Pulp and paper industry, Polymers, Chemical precipitation, Filtration, Anion adsorption, Tannery wastes, Color, Waste water treatment, Industrial wastes.

A patent has been granted for an anionic dye or bleach removal process employing filtration through cellulose treated with a polymeric precipitating agent. The degree of adsorption is controlled by treating the filter media with a basic polymeric precipitating agent and a polyanionic additive. In an example cited, 2,000 liters of waste water containing 200 mg of deep blue dye were filtered at 95-98C through a spruce sulfite cellulose medium which had been treated with dicyandiamine, urea, and a formaldehyde condensation product. The colorless filtrate had an average residual dye content of 4 mg/liter. The treatment method is suitable for bleach and dye-bearing waste water from paper, textile, and tannery industries; it requires small quantities of solution and less time than conventional coagulation process. (Lisk-FIRL)
W78-09465

FIELD STUDY TO DETERMINE THE FEASIBILITY OF ELECTRO-OSMOTIC DEWATERING OF DREDGED MATERIAL,
Army Engineer District, Mobile, AL.
For primary bibliographic entry see Field 5E.
W78-09473

SYSTEMS CLOSING IN KRAFT PULP MILLS,
Swedish Forest Products Research lab., Stockholm.
B. Warnqvist.
Manuscripts 17th EUCEPA Conferenence, October 10-14, 1977, Vienna, Austria, Vol 2, Paper No 29, p 218-231. 6 fig, 7 ref.

Descriptors: *Pulp wastes, *Waste water treatment, *Recycling, *Water conservation, *Water reuse, Wastes, Industrial wastes, Water pollution sources, Water pollution, Water pollution treatment, Pulp and paper industry, Costs, Kraft mills, Screening, Refining, Closed systems.

The large effluent volumes from a conventional brown stock screen room in a kraft mill can be reduced by recycling the decker effluent, by screening at high pulp consistency (3-5% as compared to the conventional 1-2%), and by in-line refining with minimum or no screening. Closed handling and treatment of coarse screen rejects can be accomplished by recooking or refining and recycling of rejects. Cost comparisons are made for in-plant measures to reduce effluent volumes vs. external treatment and for the options for closed rejects handling. (Swichtenberg-IPC)
W78-09488

TECHNICAL STATUS OF EFFLUENT-FREE SULFITE PULP MILLS (TECHNISCHER STAND DER ABWASSERFREI ARBEITENDEN SULFITZELLSTOFFABRIK),
Chemiefaser Lenzing AG. (Austria).
R. Hornke.
Manuscripts 17th EUCEPA Conference, October 10-14, 1977, Vienna, Austria, Vol 2, Paper No 30, p 232-247. 4 fig, 1 tab.

Descriptors: *Recycling, *Water pollution control, *Sulfite pulp mills, *Pulp wastes, Pulp and paper industry, Water pollution sources, Effluents, Bleaching wastes, Industrial wastes, Wastes, Water conservation, Waste water treatment, Waste treatment, *Water reuse, Sulfite liquors, Water pollution treatment, Technology, Black liquor, Closed systems.

This discussion reviews what is presently practicable, indicates what is lacking, and shows future possibilities in effluent control at sulfite mills. If the cook is removed without water, and if black liquor condensate is used for 80% of the diluting water (the rest being water from pulp dewatering), a recovery of 99% of the dry extract of the cook is possible. The screening effluent is kept separate from the bleaching effluent by using a closed-circuit screen with a press and controlling the use and discharge of water. About 89% of the solids can be sluiced out here and used for cooking liquor (raw acid) preparation. With radical water economy in bleaching and dewatering, concentrated waste liquors result. Measures are available for avoiding secondary waste waters. Black liquors must be evaporated in a nearly neutral state. Bleaching must be conducted with peroxide and simultaneous alkali extraction or with oxygen instead of chlorine. The technical status of concentrating the bleachery effluent and its further treatment is also discussed. (Ward-IPC)
W78-09489

WASTE PURIFICATION OF SULPHATE-CELLULOSE PRODUCTION-BY ELECTROLYSIS USING LEAD ANODE AT INCREASED CURRENT DENSITY.
Soviet Patent SU-551-263. Issued April 29, 1977. Derwent Soviet Inventions Illustrated, Vol A, No 10, p 2-3, April, 1978.

Descriptors: *Electrolysis, *Anodes, *Lead, *Electric currents, *Patents, Separation techniques, Construction materials, Chemical oxygen demand, Pulp and paper industry, Pulp wastes, Phenols, Lignins, Electrolytes, Color, Waste water treatment, Cellulose, Sulfates, Industrial wastes.

A patent has been issued for sulfate-cellulose waste water treatment by electrolysis using a high current density lead anode. The lead anode may be operated at current densities of 0.04-0.08 amp/sq cm with electrolyte flow rates of 6-10 liters/hr. In an example cited, biologically treated sulfate-cellulose wastes were electrolyzed with a lead anode operated at a current density of 0.05 amp/sq cm and a solution feed rate of 8 liters/hr, maintained at 20-80C. COD was reduced by 77.7% from 323-73.5 mg/liter; color index by 95.4%; and steam-volatile phenols by 99.3%, from 0.025-0.002 mg/liter. The high-current density process also reduced non-volatile phenols by 98.8%, from 0.016-0.0002, and lignin content by 100%. The degree of COD removal is reportedly higher with the lead anode than with a soluble iron anode. (Lisk-FIRL)
W78-09490

CHEMICAL RECOVERY AND UTILIZATION OF THE ORGANIC PART OF BLACK LIQUORS (ISSLEDOVANIYA PO REGENERATSII KHIMIKATOV I UTILIZATSII ORGANICHESKOI CHASTI OTRABOTANNYKH SUL'FATNYKH SHCHELOKOV),
Vsesoyuznyi-Nauchnyi Planovii Otel Tsellyulozno-Bumazhnoi Promyshlennost, Leningrad (USSR).
I. A. Khristyuk, V. M. Ardashnikova, L. A. Zadorina, O. I. Ignat'eva, and S. A. Sapotnitskii.
Bumazhnaya Promyshlennost, No 9, p 19-20, September, 1977. 1 ref, 2 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Kraft mills, *Chemical recovery, Pulp and paper industry, Wastes, Industrial wastes, Water pollution sources, Chemical precipitation, Lignins, Electrodialysis, Organic compounds, Organic acids, Yeasts, Steam, Phenols, Toxicity, Neutralization, Nutrients, Sulfur, Hydrogen ion concentration, Hydrogen sulfide, Waste treatment, *Black liquor.

A black liquor recovery process is described which eliminates the evaporation and combustion of the liquor. The proposed process includes precipitation of alkali lignin with organic acids (e.g., acetic acid); electrodialysis of the remaining solution to recover chemicals and separate the organic acids in the free state; recycling a part of the dialyzate for lignin precipitation; and biochemical processing of the dialyzate to produce feed yeast. Steam is blown through the acid dialyzate to remove toxic volatile phenolic compounds. The dialyzate is then neutralized, and mineral nutrients are added. The yield of Candida yeast is 35-38%. Up to 17 kg of organic acids per cu m black liquor can be used as a carbon source. In addition to full recovery of sodium and utilization of the organic components of black liquor, the method allows recovering a part of sulfur in the form of sodium sulfide, to be used in the preparation of white liquor. The content of residual sodium sulfide in black liquor does not exceed 5-7 g/liter (active sodium oxide). Acidification to a pH of 4.5-4.8 for lignin precipitation and the subsequent electrodialysis to pH 1.2-1.5 causes evolution of hydrogen sulfide, which is recovered in a scrubber sprayed with NaOH solution. This constitutes about 25% of the sulfur contained in black liquor. (Stapinski-IPC)
W78-09492

PURIFICATION OF EFFLUENTS OF PAPER MILLS PROCESSING WASTE PAPER (OCHISTKA STOCHNYKH VOD BUMAZHNYKH FABRIK, PERERABATYVAYUSCHIKH MAKULATURU),
B. S. Potskhvershvili, L. S. Murguliya, and Z. S. Dzvelaya.
Bumazhnaya Promyshlennost, No. 9, p 29-30, September, 1977. 3 fig, 2 tab.

Descriptors: *Pulp wastes, *Waste water treatment, *Coagulation, *Clays, Waste treatment, Water pollution treatment, Pulp and paper industry, Water pollution sources, Lime, Suspended solids, Sedimentation rates, Color, Hydrogen ion concentration, Density, Sediments, Water purification, Waste paper, Sulfuric acid, Aluminum sulfate.

Georgian (USSR) bentonite clays (askagel and gumbrin) in combination with sulfuric acid, aluminum sulfate, and lime were tested as coagulating agents for clarification of effluents of a paper mill and a board mill, both using waste paper stock in their products. Askagel in combination with lime or with sulfuric acid and aluminum sulfate gave the best results. Data are given on the suspended solids sedimentation rate, the sediment density, the color and pH of the clarified effluents, and the consumption of the coagulant. (Stapinski-IPC)
W78-09493

REVERSE OSMOSIS AND ULTRAFILTRATION (REVERSOMOSE UND ULTRAFILTRATION),
Technische Hochschule, Vienna (Austria). Inst. fuer Verfahren-stechik und Technologie der Brennstoffe.
A. E. Hackl.
Das Oesterreichische Papier, Vol 14, No 10, p 22-24, No 12, p 43-46, October, December, 1977. 9 fig, 9 ref, 5 tab.

Descriptors: *Pulp wastes, *Sulfite liquors, *Bleaching wastes, *Waste water treatment, *Reverse osmosis, *Ultrafiltration, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Membrane processes, Separation techniques, Pulp and paper industry, Chemical oxygen demand, Color, Waste treatment, Osmosis, Water pollution control, Softwood, Sugars, Black liquor, Condensates, Sulfite pulp mills.

The principles and some industrial uses of reverse osmosis and ultrafiltration are briefly described, including applications in the pulp and paper industry. Experiments are then reported for studying reverse osmosis of condensates and bleachery effluents and ultrafiltration of pulping effluents, all from sulfite mills, as well as a three-stage process (ultrafiltration for the first two and reverse osmosis for the final stage) for concentrating a softwood sulfite effluent. Finally, treatments of black liquor, sulfite effluent, and paper mill effluents via both techniques are compared. Ultrafiltration was effective in preliminary concentration of, and sugar separation from, sulfite liquor and in removing COD and color from paper mill effluents. Reverse osmosis following ultrafiltration gave the best results for all types of effluents. (Ward-IPC)
W78-09494

WATER AND ITS ROLE IN PAPERMAKING (WASSER UND SEINE ROLLE BEI DER PAPIERHERSTELLUNG),
Chemische Fabrik Pelzer und Roehrl, Mainz (West Germany).
For primary bibliographic entry see Field 3E.
W78-09495

FUNDAMENTALS OF BIOLOGICAL EFFLUENT PURIFICATION (GRUNDLAGEN DER BIOLOGISCHEN ABWASSERREINIGUNG),
Papierfabrik Biberist (Switzerland).
J. C. Ulrich.
Das Papier, Vol 31, No 10A, p V74-V77, V104-V108 November, 1977. 3 fig, 2 tab. English summary.

Descriptors: *Waste water treatment, *Biological treatment, Waste treatment, Microorganisms, Aerobic treatment, Enzymes, Dissolved solids, Energy, Nutrients, Nitrogen compounds, Nitrification, Temperature, Oxygen, Trace elements, Hydrogen ion concentration, Biodegradation, Water purification, Inorganic compounds, Organic compounds, Carbon compounds.

The primary aim of biological effluent purification is to remove dissolved organic matter which nourishes microorganisms in the effluent and thus affects oxygen consumption indirectly. Biological effluent purification is an artificially increased self-cleaning, involving microorganisms mainly. Only aerobic environments are used industrially.

Both dissolved and undissolved substances are consumed by the microorganisms, partly with the assistance of enzymes; they are used, in complicated biochemical reactions, to build up body substance and to produce energy. The breakdown of the nutrients in the effluent has two stages, first, the attack on the carbon compounds and, secondly, on the nitrogen compounds (nitrification). The breakdown is temperature-dependent and is influenced by several other parameters, e.g., oxygen concentration, trace elements, and pH. Biological clarification processes are briefly described. (Ward-IPC)
W78-09496

CONSIDERATIONS REGARDING THE LAYOUT OF A BIOLOGICAL TREATMENT STAGE (UEBERLEGUNG ZUR AUSLEGUNG EINER BIOLOGISCHEN KLAERSTUFE),
Steinbeis and Co., Gemmrigheim (West Germany).
F. Riegel.
Das Papier, Vol 31, No 10A, p V77-V81, V104-V108, November, 1977. 5 fig, 2 ref, 2 tab. English summary.

Descriptors: *Waste water treatment, *Biological treatment, *Treatment facilities, Design, Waste treatment, Water pollution treatment, Construction, Aeration, Control systems, Industrial plants, Optimization, Degradation(Decomposition), Planning, Project planning, Laboratory tests, Water pollution control.

Before a biological treatment step is introduced, the industrial plant must be adapted to the project; the hydraulic load must be minimized, processes optimized, and raw materials chosen with regard to expected biological load. Special attention must be given to systematic and thorough measurement of the composition of the incoming water. The importance of laboratory degradation tests for planning the layout is discussed, and the essential parameters for designing a biological clarification unit are pointed out. Current biological purification processes are reviewed. Finally, construction considerations are dealt with in regard to pollution control, recommending possible aeration systems and control equipment. (Ward-IPC)
W78-09497

START-UP AND OPERATION OF BIOLOGICAL TREATMENT PLANTS IN PAPER MILLS (INBETRIEBNAHME UND BETRIEB VON BIOLOGISCHEN KLAERANLAGEN IN PAPIERFABRIKEN),
G. Klapprott.
Das Papier, Vol 31, No 10A, p V81-V84, V104-V108, November, 1977. 2 fig, 2 ref. English summary.

Descriptors: *Pulp and paper mills, *Waste water treatment, *Biological treatment, *Operation and maintenance, Performance, Waste treatment, Water pollution treatment, Economics, Training, Personnel, Information exchange, Sludge, Pulp wastes, Testing, Water pollution sources, Wastes, Industrial wastes, Start-up.

Certain measures are described which are useful or necessary before and during the startup of a biological effluent clarification unit. They include meetings with various agencies and staff members concerned, and the most important performance tests. The initial operation with fresh water for performance testing is described, followed by a test run with partial and, finally, with total effluent load. The startup will take 4 or 5 weeks, until the sludge concentration builds up to the required value. Various operational experiences are described which might indicate possible difficulties with design or process. Other points discussed are economical consideration, training of operators, and exchange of information between treating plant and paper mill. (Ward-IPC)
W78-09498

LIMITS OF BIOLOGICAL PURIFICATION OF PULP MILL EFFLUENTS (GRENZEN DER BIOLOGISCHEN REINIGUNG VON ZELLSTOFFABRIKATIONSABWAESSERN),
Papierwerke Waldhof-Asschaffenburg A. G., Stockstadt am Main (West Germany).
W. Czirnich.
Das Papier, Vol 31, No 10A, p V85-V87, V104-V108, November, 1977. 1 tab. English summary.

Descriptors: *Discharge measurement, *Pulp wastes, *Chemical oxygen demand, *Legislation, Discharge(Water), Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Biological treatment, Europe, Effluents, Bleaching wastes, Taxes, Woodyard, Condensates, Germany, Assessments, Legal aspects, Waste water(Pollution).

In enforcing the effluent tax law and assessments for industrial discharges, the determining parameter for oxygen-consuming effluent pollution will be the COD. In the present official German requirements, there are several parameters which describe the effluent load differently. Some of the difficulties in computing COD are dealt with. The total effluent from pulp mills is composed of very different contributing streams. The technical difficulties and feasibilities for biological treatments of the streams from woodyards, digesters, condensates, and bleacheries are considered. (Ward-IPC)
W78-09499

EXPERIENCE WITH EFFLUENT TREATMENT IN AN INTEGRATED PULP AND PAPER MILL (ERFAHRUNGEN MIT DER ABWASSERBEHANDLUNG IN EINER INTEGRIERTEN ZELLSTOFF-UND PAPIERFABRIK),
Feldmeuhle A. G., Baienfurt (West Germany).
H. Solbach.
Das Papier, Vol 31, No 10A, p V87-V91, November, 1977. 3 fig, 2 illus, 5 tab. English summary.

Descriptors: *Waste water treatment, *Pulp wastes, *Biological treatment, *Activated sludge, Wastes, Industrial wastes, Water pollution treatment, Water pollution sources, Pulp and paper industry, Biochemical oxygen demand, Chemical oxygen demand, Trickling filters, Bleaching wastes, Waste treatment, Separation techniques, Adsorption, *Lake Constance, Aluminum oxide.

A description is given of how an integrated pulp and board mill met the standards of the Lake Constance water pollution control commission and the official BOD and COD requirements of 20 mg oxygen and 80-150 mg permanganate/liter. First, a single-stage biological treatment plant (trickling filter) was installed for partial degradation; this was followed by an activated-sludge unit as second stage. The results with total effluent are shown, including the effect of increasing spend liquor collection from the pulp mill from 88% to 98%. The target could not be fully met due to the bleachery effluents. A new treatment for this tributary stream, adsorption on activated alumina, described here for the first time, was developed. About 80% COD elimination could be attained; since the residual load is largely broken down biologically, about 90% COD reduction is attained for the total effluent. (Ward-IPC)
W78-09500

PROBLEMS OF BIOLOGICAL PURIFICATION OF EFFLUENTS FROM SPECIALITY PAPER MILLS WITH INTEGRATED PULP PRODUCTION (DIE PROBLEME DER BIOLOGISCHEN REINIGUNG VON ABWAESSERN AUS SPEZIALPAPIERFABRIKEN MIT INTEGRIERTER HALBSTOFFERZEUGUNG),
Papierfabrik Cordier G.m.b.H., Bad Duerkheim (West Germany).
D. Cordier.
Das Papier, Vol 31, No 10A, p V91-V93, V104-V108, November, 1977. 1 tab. English Summary.

Descriptors: *Pulp wastes, *Biological treatment, *Waste water treatment, Wastes, *Industrial wastes, Water pollution sources, Water pollution treatment, Europe, Foreign countries, Chemical oxygen demand, Flocculation, Sludge, Pulp and paper industry, Water purification, Economics, Burning, Incineration, Oxidation, Black liquor, Wet oxidation, Germany, Specialty papers, Costs.

Integrated specialty paper mills stock preparation processes causing effluent loads similar to those of larger pulp mills, but effluent collection and removal are too expensive for such comparatively small operations. The example given, Papierfabrik Cordier GmbH, produces mainly cotton-content paper using alkali-cooked and bleached linters in the stock. The 20 ton/day pulp mill is too small to justify burning of the black liquor, which contains most of the COD of the intergrated plant. Efforts to purify the pulping liquor by various types of flocculation all gave sludge problems in biological purification. Most satisfactory was the Zimpro wet oxidation process at high pressure, but this is an expensive solution. (Ward-IPC)
W78-09501

EFFICIENCY AND COSTS OF BIOLOGICAL EFFLUENT TREATMENT PLANTS IN PULP AND PAPER MILLS (WIRKUNGSEFFEKTE UND KOSTEN VON BIOLOGISCHEN ABWASSERREINIGUNGSANLAGEN IN ZELLSTOFF-UND PAPIERFABRIKEN),
Technische Hochschule, Damstadt (West Germany). Inst. fuer Papierfabrikation; and Technische Hochschule, Damstadt (West Germany), Wasser-und Abwasserfunschungsstelle.
H. L. Dalpke.
Das Papier, Vol 31, No 10A, p V94-V98, V104-V108, November, 1977. 8 fig, 3 tab, English summary.

Descriptors: *Pulp wastes, *Waste water treatment, *Biological treatment, *Costs, *Efficiencies, Water pollution treatment, Water pollution sources, Wastes, Industrial wastes, Pulp and paper industry, Surveys, Europe, Biochemical oxygen demand, Chemical oxygen demand, Operating costs, Capital costs, Economic impact, Waste treatment, Germany, Switzerland.

The results of a 1976 survey of 19 pulp and paper mills, including almost all German and Swiss pulp and paper mills operating biological clarifiers, are presented and discussed. Starting from the officially required standards and the absolute and relative loads of these clarifiers, the efficiency as regards BOD and COD is stated and related to clarifier parameters. The technical data are supplemented by investment and operating costs and by total costs per cu m of effluent, per ton of product, and per kg of BOD decrease, with some mention of the economic impact of the biological treatment. (Ward-IPC)
W78-09502

DEWATERING AND DISPOSAL OF BIOLOGICAL SLUDGE (ENTWAESSERUNG UND BESEITIGUNG VON BIOLOGISCHEM SCHLAMM),
Hannoversche Papierfabriken Alfeld (West Germany).
For primary bibliographic entry see Field 5E.
W78-09503

SPECIAL PROBLEMS OF PAPER MILLS CONNECTED TO OUTSIDE SEWAGE TREATMENT PLANTS (DIE BESONDEREN BELANGE DER AN FREMDE KLAERANLAGEN ANGESCHLOSSENEN PAPIERFABRIKEN),
Muenchen-Dachauer Papierfabriken Heinrich Nicolaus G.m.b.H. (West Germany).
G. Strittmatter.
Das Papier, Vol 31, No 10A, p V101-V108, November, 1977. 87 ref, 1 tab. English summary.

Descriptors: *Pulp and paper industry, *Waste water treatment, *Sewage treatment, Europe, Costs, Economics, Water pollution treatment, Wastes, Industrial wastes, Water pollution sources, Pulp wastes, Waste treatment, Germany, Joint treatment.

For various reasons, many paper mills, especially small ones, are interested in being connected to an outside sewage treatment plant. This article points out some difficulties which may arise in this procedure. It is based on a questionnaire replied to be 44 such German paper mills. Most important are clear, not too restrictive, long-term contracts between the parties, requiring thorough preparation in the paper mill, such as exact effluent analysis. Cost evaluations are of great importance. Some potential problems and case histories are given. (Ward-IPC)
W78-09504

POLLUTION FROM SEVERAL WOOD SPECIES IN HARDBOARD PRODUCTION,
Industrial Environmental Research Lab.- Cincinnati, Corvallis, OR. Food and Wood Products Branch.
For primary bibliographic entry see Field 5B.
W78-09506

TREATMENT OF CONDENSATE RETURNS AT INDUSTRIAL PLANTS,
Ecodyne Corp., Union, NJ. Graver Water Div.
L. Limon.
Journal of Engineering for Power, Vol 99, p 269-273, April, 1977. 4 fig, 1 illus, 8 ref, 1 tab.

Descriptors: *Waste water treatment, *Condensates, *Industrial plants, Wastes, Industrial wastes, Pulp and paper industry, Filtration, Ion exchange, Demineralization, Filters, Boilers, Resins, Waste treatment, Water pollution treatment, Water pollution sources, Magnetic filters, Steam condensates.

It appears that with the newer designs of industrial boilers as well as the more stringent steam quality requirements, boiler condensate treatment is becoming almost a necessity for the average large industrial plants. Methods of treatment are reviewed, including filtration, sodium-cycle ion-exchange polishing, treatment using Powdex ion-exchange resins, demineralizing, and the use of magnetic filters. Field experience with sodium-cycle ion-exchange polishers and with Powdex units is reported. The pulp and paper industry has been the largest user of industrial condensate treatment. (Speckhard-IPC)
W78-09509

REMOVAL OF METHANOL FROM THE SULPHATE (PULPING) PROCESS,
Rosenlew (Oy. W.) A. B., Pori (Finland).
A. A. R. Ronnholm.
Paperi ja Puu, Vol. 59, No. 11, p 721-722, 725-726, 729-732, November, 1977. 9 fig, 24 ref, 4 tab.

Descriptors: *Pulp wastes, *Water pollution sources, *Biochemical oxygen demand, *Methyl alcohol, *Kraft pulping, Kraft mills, Wastes, Industrial wastes, Pulp and paper industry, Alcohols, Energy, Odor, Water pollution, Sulfur compounds, Waste treatment, Waste water treatment.

Methyl alcohol produced during kraft cooks causes serious water pollution when discharged into rivers or lakes, as it is the major component of kraft mill effluent BOD loads. Depending on wood species, methyl alcohol can contribute 9 to 19.5 kg of BOD per oven-dry metric ton of pulp. Effective methanol removal with the least possible amount of energy will not only considerably reduce the BOD of kraft mill effluents but also lower the emission of odorous sulfur volatiles. (Brown-IPC)
W78-09510

COMPOSITION OF BEECH MAGNEFITE PULP BLEACHING EFFLUENT (ZLOZENIE ODPADOVYCH VOD Z BIELENIA BUKOVEJ MAGNEFITOVEJ BUNICINY),
Vyskumny Ustav Papieru a Celulozy, Bratislava (Czechoslovakia).
For primary bibliographic entry see Field 5B.
W78-09514

ANALYSES OF PAPER MACHINE WATERS WITH ION SPECIFIC ELECTRODES. PART III. VARIOUS MEASUREMENT METHODS USING CHLORIDE ION SPECIFIC ELECTRODE,
Valmet Oy., Jyvaskyla (Finland).
For primary bibliographic entry see Field 5A.
W78-09523

THE EFFECTIVENESS OF THE INTRODUCTION OF A CIRCULATION CANAL FOR PURIFICATION OF SEWAGE WATER FROM A MILK PLANT (IN RUSSIAN),
V. F. Kurts, and N. L. Rashchuk.
Gig Sanit (5), p 94-95, 1977.

Descriptors: Ambient temperature, Microbes, Russian-SFSR, Urals, USSR, *Oxidation canals, *Waste water treatment, *Industrial wastes, *Milk plant wastes.

At the milk plant of the Tyubuskiy State Farm (Russian SFSR, USSR) an experimental circulation oxidation canal was constructed to purify plant sewage before discharge into the small Sinara River. A 4-yr. stud of the hygienic effectiveness of the canal revealed that fluctuations of the basic indices of temperature, pH, suspended substances, general N, ammonia and phosphates and BOD (biochemical O2 demand) resulted in ineffective sewage purification during certain times of the year. At temperature of -25 degrees C the equipment stopped working and efforts to warm the sewage failed to prevent its temperature from falling below 4 degrees C at which point microbial populations declined. Introduction of the system in the Southern Urals where the mean annual air temperature is less than 2.3 degrees C is considered impractical.--Copyright 1978, Biological Abstracts, Inc.
W78-09545

MICROBIAL TRANSFORMATION OF (14)C-LABELLED 2,4,6-TRINITROTOLUENE IN AN ACTIVATED-SLUDGE SYSTEM,
Army Natick Research and Development Command, MA.
D. F. Carpenter, N. G. McCormick, J. H. Cornell, and A. M. Kaplan.
Applied and Environmental Microbiology, Vol. 35, No. 5, p 949-954, 1978. 4 fig, 1 tab, 23 ref.

Descriptors: *Activated sludge, *Lipids, *Proteins, *Radioactivity, *Carbon radioisotopes, Nitrogen compounds, Distillation, Biodegradation, Metabolism, Chemical precipitation, Biomass, Infrared radiation, Gas chromatography, Polymers, Waste water treatment, Industrial wastes.

The distribution of (14)C-labelled, 2,4,6-trinitrotoluene (TNT) in an activated sludge system was measured after incubation periods of 3 and 5 days. The (14)C was concentrated in the floc fraction, with less than 0.5% of the radioactivity released in (14)CO2 produced by the sludge microorganisms. The floc fraction was further fractionated to form pellets, supernatant, carbohydrates, lipids, nucleic acids, proteins, and residues. Centrifuged floc pellets contained 50% of the radioactivity in the 3-day incubation test and 52.4% in the 5-day reactor. The lipid fractions of the 3 and 5 day samples contained 30.6% and 20.5% of the radioactivity, respectively, with lesser amounts contained in the protein fraction. The radioactivity in the fractionated lipids was not incorporated into the triglycerides or phosphatides, but remained on the gas chromatography column. Thin layer chromatography of the fractionated protein confirmed that the amino acids did not contain (14)C. The bulk of the radioactivity in the lipid and protein fractions was contained in precipitates from these fractions; the lipid and protein precipitates contained amide and ester linkages, respectively. These cross-linked polymers were attributed to the reaction of fatty acids and glycerides with TNT bioreduction products in the lipid fraction and the reaction of carboxylate groups with TNT bioconversation products in the protein fraction. (Lisk-FIRL)
W78-09553

TREATMENT OF AMMONIUM SULFATE EFFLUENTS BY REVERSE OSMOSIS,
Kuwait Univ., Dept. of Chemical Engineering.
H. I. Shaban, A. M. Akbar, and M. A. Fahim.
Journal of Environmental Sciences and Health, Vol. 13, No. 4, p 315-324, 1978. 6 fig, 5 ref.

Descriptors: *Reverse osmosis, *Ammonium compounds, *Fertilizers, *Membrane processes, *Chemical wastes, Membranes, Desalination, Permeability, Separation techniques, Osmotic pressure, Flow rates, Waste water treatment, Water purification, Industrial wastes.

Reverse osmosis recovery of ammonium sulfate for the fertilizer industry was evaluated in pilot studies with ammonium sulfate neutralizing pit effluent at concentrations ranging 0.1-1.5% by weight. The ROGA-type module used in the study contained spirally-wound sheets of cellulose-acetate membrane, manufactured by Gulf Environmental Systems. Permeate flux and desalination ratio were calculated from initial tests in which the flow was maintained at 12 liters of 0.5% effluent/hr and pressure levels were varied between 340, 360, and 470 lbs/sq inch gage. The membrane, with a 4.65 sq m surface area, was stable for 300 hrs. Osmotic pressure differential increased with increasing feed concentration, while the desalination ratio decreased. Permeate flux and desalination ratio increased as the flow rate increased; water recovery averaged 98%, indicating laminar flow conditions even with the highest flow rates. Ammonium sulfate effluent strength was reduced by 50% in the permeate flux from a single reverse osmosis nodule; brine solutions were concentrated 20-fold with respect to the initial concentration after membrane processing. (Lisk-FIRL)
W78-09554

BIOLOGICAL TREATMENT SOLUTIONS UTILIZE FLUID JET GAS/LIQUID CONTACTING AND MIXING,
M. G. Mandt.
Industrial Wastes, Vol. 24, No. 3, p 34, 37-41, May/June, 1978. 9 fig, 6 tab, 4 ref.

Descriptors: *Aeration, *Jets, *Biological treatment, *Chemical wastes, Pulp and paper industry, Chemical industry, *Pulp wastes, Activated sludge, Aerated lagoons, Biochemical oxygen demand, Mixing, Oxygen demand, Sulfite liquors, Waste water treatment, Industrial wastes.

Jet gas-liquid mixing and aeration systems were evaluated for biological treatment of chemical wastes, pulp wastes, and sulfite liquors. Jet mixing establishes a high gas-liquid interface area along which mass transfer occurs; bubble release from the inertial plume forms a rising buoyant plume which is re-entrained during mixing. A Penberthy jet aeration system installed in an organic chemical plant manufacturing isocynates reduced the average BOD load of 200 mg/liter in the primary clarified effluent by 93-96.4%, with a maximum oxygen uptake rate of 127 mg/liter/hr; suspended solids were reduced by 95.8%. A Penberthy jet aeration system installed in a coated paper and specialty pulp mill treated a combined stream of neutralized black liquors from kraft and sulfite pulping. Based on a 3 mgd deep channel design of

the Pasveer oxidation ditch, seven Penberthy directional mix headers with oxygen jets operating at 800-2,500 cu ft/min provided channel velocities of 1 ft/sec. The system consistently handled BOD load fluctuations of 3,900-11,830 lb/day, with oxygen uptake rates up to 820 lb/hr and high oxygen transfer rates. Application of a Penberthy aeration system to a 14 mgd waste stream with a BOD loading of 44 lb/1000 cu ft/day from a pulp and paper mill utilizing activated sludge treatment produced an 88% BOD removal. Four directional mix aerators, in conjunction with an Eddy mix jet aerator, provided a standard oxygenation capacity of 5.3 lb oxygen/hp/hr with adsorption efficiencies of 46-47%. (Lisk-FIRL)
W78-09555

POTENTIAL FOR WATER REUSE IN AN EGYPTIAN POULTRY PROCESSING PLANT,
Alexandria Univ. (Egypt). Higher Inst. of Public Health.
A. Hamza, S. Saad, and J. Witherow.
Journal of Food Science, Vol. 43, No. 4, p 1153-1157, 1161, 1978. 3 fig, 6 tab, 9 ref.

Descriptors: *Poultry, *Food processing industry, *Recycling, *Water reuse, *Flow profiles, Water utilization, Bacteria, E. coli, Pseudomonas, Multiple purpose, Waste water treatment, Industrial wastes.

Approximately 65% of the process water used in an Egyptian poultry processing plant may be saved through process modifications, water renovation, and multiple reuse. The poultry processing operation utilized about 412.3 cu m water/day at a rate of 31.5 liters/bird. Scalding and defeathering operations accounted for 47% of the plant's water consumption, requiring about 9.2 liters/bird of waste and fresh water to flume the feathers to a rendering area. Wastes from this area of operation averaged 217.5 kg/day COD, 165.7 kg/day BOD, and 225.6 kg/day total residue; these wastes were highly contaminated with bacteria, blood, and other residues. The final effluent from this process and bleeding, evisceration, washing, chilling, and condenser operations contained 530.0 kg/day COD, 426.8 kg/day BOD, and 609.6 kg/day total residue. Effluent bacteria counts were dominated by E. coli, Pseudomonas, and Proteus; effluent bacterial counts were directly related to counts on the poultry carcasses during the various processes. Bacterial counts on the carcasses during weighing and packaging could be reduced by less human contact during these operations. A multiple water use system instituted in the plant included recycling the second chiller water to the first chiller; reusing washing water as makeup in the scalding operation; and continuously feeding uncontaminated compressor cooling waters to the scaling tank. Modification of the evisceration process and renovating and recycling of condenser water will also reduce water usage. Magnesium and iron were the only trace metals found to exceed potable water standards in the effluents. (Lisk-FIRL)
W78-09556

PILOT PLANT TREATMENT OF MUNICIPAL AND MALTING PLANT WASTEWATERS,
North Dakota State Univ., Fargo. Coll. of Engineering and Architecture.
D. Richard, R. Haag, D. Sheth, and R. J. Hynek.
Journal Water Pollution Control Federation, Vol. 50, No. 5, p 869-874, May, 1978. 7 fig, 1 tab.

Descriptors: *Biological treatment, *Food processing industry, *Domestic wastes, *Filtration, *Pilot plants, Hydraulic design, Flowrates, Biochemical oxygen demand, Activated sludge, Trickling filters, Waste water treatment, Design criteria, Industrial wastes.

Biological treatment of combined municipal and malting industry wastes was evaluated in pilot plant studies at Moorhead, Minnesota. The existing municipal activated sludge-trickling filter treatment plant was to be expanded from a capacity of 4.5 mgd to 5.25 mgd. The pilot plant was equipped with a fixed media, rotating biological reactor which was operated at flow rates of .235, .143, and .118 cu m/sq m/day. The combined malting and domestic wastes contained 905 mg/liter total BOD, 1,340 mg/liter total COD, and 180 mg/liter total suspended solids; the organic loading of the biological reactor was maintained at 1,464 g BOD/cu m at a flow rate of .235 cu m/sq m/day. The rotating biological reactor was also tested for treatment of municipal waste alone, accommodation of varying feed rates, and treatment of high strength synthetic wastes. BOD in the combined effluent was not consistently reduced by the biological reactor system, operated at hydraulic loads of .235 cu m/sq m/day, because of the high flow and strength of the waste water. The biological reactor consistently reduced BOD in municipal wastes alone when operated at .143 cu m/sq m/day with distributed feeding. BOD in the high strength synthetic effluent was reduced by about 93% with four-point distributed feed at hydraulic loadings of .118 cu m/sq m/day. Results of the pilot study indicated that the biological shaft reactor could be operated in conjunction with the existing treatment plant at a hydraulic loading of 2.1 gpd/sq ft and an organic loading of 34.16 g/sq m on a distributed or step-feed basis. (Lisk-FIRL)
W78-09557

FATE OF AFLATOXIN B2 IN A TWO-STEP MICROBIAL RECOVERY SYSTEM FOR FOOD INDUSTRY WASTES,
Economics Lab., Inc., St. Paul, MN. Capsule Testing Labs.
K. M. Johnson, and F. F. Busta.
Journal of Food Science, Vol. 43, No. 4, p 1303-1306, 1978. 4 fig, 16 ref.

Descriptors: *Food processing industry, *Lactobacillus, *Molds, *Cultures, *Proteins, Toxicity, Chromatography, Incubation, Analytical techniques, Microbial degradation, Laboratory tests, Waste water treatment, Industrial wastes.

Single cell protein recovery from food processing wastes was evaluated by a two-step microbial recovery system using Bacillus subtilis and Lactobacillus acidophilus in the presence of hepatocarcinogenic aflatoxin B2. B. subtilis was cultured for 4 hr at 37C in a model food processing waste medium spiked with 800 ppb aflatoxin B2, followed by centrifugation, penicillin inactivation, and further incubation of the supernatant. This modified medium was then innoculated with L. acidophilis, incubated for 12 hrs, and centrifuged for single cell protein harvesting. L. acidophilis was also grown separately in a protein-starch model waste medium. Aflatoxin B2 extracted from the total, supernatant, and pellet fractions of the medium was quantified by high-pressure liquid chromatography. L. acidophilis growth in the B. subtilis hydrolized medium was 100 times greater than the growth in the unmodified medium. Mean recovery of aflatoxin B2 was 55.9% from the total medium in all tests, 62.0% from the supernatant, and 65.1% from B. subtilis pellets. The two-stage microbial recovery system did not reduce the aflatoxin B2 levels. The cells also dis not concentrate the substance, indicating that single cell protein recovery from food processing wastes could be performed in the presence of aflatoxin. (Lisk-FIRL)
W78-09558

TREATMENT OF PLATING WASTES FROM THE AUTOMOTIVE INDUSTRY,
M. J. Cullinane, Jr., and J. D. Dietz.
Industrial wastes, Vol. 24, No. 2, p 29-32, March-April, 1978. 6 fig, 3 tab.

Descriptors: *Metals, *Chemical precipitation, *Equalizing reservoirs, *Flocculation, *Chromium, Lime, Sludge disposal, Flow separation, Waste water treatment, Industrial wastes.

Water consumption reductions and waste stream separation and treatment were employed to optimize waste water treatment operations in an automotive metal plating plant. Waste streams included: oily roll-building wastes, chromium-contaminated plating and cooling tower waters, alkaline buffing wastes high in suspended solids, cooling water and steam condensate, and sanitary wastes. The projected design waste water flow rate was 200 gpm/operation from buffing, plating, and other sources after water consumption measures were installed; effluent quality standards were selected to be 8-15 mg BOD/liter, pH 7.8-8.2, 5-15 mg suspended solids/liter, 0.06-0.15 mg total chrome/liter and 5-20 mg/liter fats, grease, and oils. Chemical reduction and precipitation were selected for the industrial wastes; sanitary wastes were discharged to a municipal treatment facility. Chrome plating rinse water consumption was reduced from 400 to 60 gpm by installation of a modified countercurrent rinse system employing five rinse tanks and spray rinsing. Separated chromium wastes were treated with sulfuric acid and sulfur dioxide for hexavalent chromium reduction, followed by mixing with the total plant flow and transport to an equalization basin. The effluent was pumped to a flash mixer for lime or sulfuric acid pH adjustment to 8.0-8.5, followed by flocculation and settling in a reactor-clarifier vessel. Supernatant was returned to the head of the treatment process and sludge was pumped to a storage lagoon. (Lisk-FIRL)
W78-09559

CHARGED MEMBRANE ULTRAFILTRATION OF TOXIC METAL OXYANIONS AND CATIONS FROM SINGLE- AND MULTISALT AQUEOUS SOLUTIONS,
Kentucky Univ., Lexington. Dept. of Chemical Engineering.
D. Bhattacharyya, M. Moffitt, and R. B. Grieves.
Separation Science and Technology, Vol. 13, No. 5, p 449-463, 1978. 7 fig, 4 tab, 6 ref.

Descriptors: *Membrane processes, *Filtration, *Toxins, *Metals, *Saline water, Arsenic compounds, Cadmium, Sulfates, Separation techniques, Membranes, Ion exchange, Anions, Cations, Sodium, Waste water treatment, Industrial wastes.

Ultrafiltration by a continuous flow, negatively charged, non-cellulose membrane removed As(V), Se(IV), As(III), and Cd(II) from a single and multisalt aqueous solutions. The Millipore PSAL membrane, with a surface area of 50.3 sq cm and a resistance of 450 million Pa/cm/sec, was operated at transmembrane pressure differences of 280-560 kPa/sq m for single salt solutions bearing toxic metal concentrations of 0.5-20 mM over pH values of 5-10. Higher rejections were apparent for divalent oxyanions, As(V) and Se(IV), at pH 9 than for monovalent species at pH 5; monovalent, as well as divalent oxyanion rejection, improved with increasing transmembrane pressure differences. When sodium was employed as a counter ion at a transmembrane pressure difference of 560 kPa/sq m, the rejections of 6.0 mM single salt solutions of NaH2AsO4, NaHSeO3, and CdSO4 were 0.88, 0.85, and 0.92, respectively, at pH 5. The rejections of anionic 3.0 mM NaH2AsO4 and NaHSeO3 were 0.84 and 0.79, respectively, at pH 5 and 280 kPa/sq m transmembrane pressure. Monovalent oxyanion rejection under the same conditions but in the presence of sulfate was 0.84 for As(V) and 0.73 for Se(IV); without sulfate, rejections were 0.87 for As(V) and 0.75 for Se(IV). Rejections of multisalt solutions of As(V) and Se(IV) at pH 5 were similar to those of single salt solutions. Rejection of Se(IV) was hindered by CdSO4 and by a 24 mM sulfate concentration in a 2mM multisalt solution at pH 5. (Lisk-FIRL)
W78-09560

IMPROVED METHODS OF OIL-IN-WATER ANALYSIS,
General Motors Corp., Detroit, MI. Detroit Diesel Allison Div.
For primary bibliographic entry see Field 5A.
W78-09561

TREATING AQUEOUS EFFLUENTS OF THE PETROCHEMICAL INDUSTRY,
Shell Internationale Chemie, The Hague (Netherlands).
S. J. Nijst.
Environmental Science and Technology, Vol. 12, No. 6, p 652-656, 1978. 5 fig, 3 tab.

Descriptors: *Oil industry, *Chemical wastes, *Oil wastes, *Biological treatment, *Activated carbon, Adsorption, Filtration, Model studies, Suspended solids, Chemical oxygen demand, Biochemical oxygen demand, Capital costs, Operation and maintenance, Costs, Data collections, Waste water treatment, Industrial wastes.

A task force study of petrochemical industrial waste loads and methods of treatment, conducted by the Petrochemical/Ecology Sector Group of the European Council of Chemical Manufacturers' Federations in Brussels, Belgium, selected biological treatment as the most economical and effective treatment method available. As the properties of the petrochemical raw waste loads were similar in the plants studied to those values used by the EPA to determine United States effluent guidelines, the EPA figures on raw waste loads were used in formulating a model petrochemical complex. Biological treatment can consist of activated sludge, extended aeration, biodiscs, or trickling filters in conjunction with auxiliary systems of physical or chemical waste water conditioning, depending upon the characteristics of the raw waste load. The task force also recommended sand or multimedia filtration for suspended solids removal, followed by activated carbon adsorption to reduce residual COD. The task force opted for a BOD removal standard of 93% rather than EPA's 96%. A model petrochemical treatment plant, with an influent waste load of 975 cu m/hr, reduced COD by 78% to 468 mg/liter and BOD by 93% to 36 mg/liter with biological treatment; activated carbon requirements were calculated as 1.54 kg carbon/cu m effluent. Costs associated with the treatment system construction and operation, sewer systems, and materials were calculated. (Lisk-FIRL)
W78-09562

COLOR REMOVAL IN DRAFT MILL WASTEWATER USING RECYCLED MAGNESIUM,
Rush Engineering Services Ltd., Listowel (Ontario).
R. J. Rush, and W. K. Oldham.
Journal Water Pollution Control Federation, Vol. 50, No. 5, p 875-883, May, 1978. 14 tab, 4 ref.

Descriptors: *Pulp and paper industry, *Pulp wastes, *Magnesium, *Lime, *Chemical precipitation, Color, Carbon dioxide, Hydrogen ion concentration, Alkalinity, Coagulation, Waste water treatment, Industrial wastes.

Color removal in kraft mill waste water using lime and recycled Mg(+2) recovered from the sludge supernatant by recarbonation was investigated in jar and batch tests. Approximately 71-95% of the initial Mg(+2) added to the system could be recovered in the supernatant by recarbonation of the sludge in the color precipitation reactor. Jar tests using lime alone demonstrated that 20,000-40,000 mg/liter Ca(OH)2 would be required to reduce the color of caustic extraction effluent by 89.9-93.1%. A 300 mg/liter dose of fresh Mg(+2), in conjunction with 2,500 mg/liter Ca(OH)2 and 2 mg/liter polymer, reduced color by 92.6%. Color removal efficiency was reduced when recycled Mg(+2) replaced fresh Mg(+2) at the same lime and polymer dose. The reduced efficiency of the recycled Mg(+2) treatment was attributed to a lower effluent pH resulting from the alkalinity of the samples. Increasing the lime dosage to 5,000 mg/liter permitted a color removal of 93.4% with 240 mg/liter recycled Mg(+2) and 60 mg/liter fresh Mg(+2). Total mill effluent color was reduced by 93.0% with lime dosage of 625 mg/liter, 48 mg/liter recycled Mg(+2), and 12 mg/liter fresh Mg(+2); these doses were selected for batch tests with total mill and caustic extract effluent. Batch tests achieved a 94.8% color reduction in caustic extraction effluent with 80% recycled Mg(+2) doses. Lime recovery was also improved by the use of recycled Mg(+2). (Lisk-FIRL)
W78-09564

LANDFILL RECYCLES WASTE PAPERMILL SLUDGE,
Ayres (Owen) and Associates, Inc., Eau Claire, WI.
D. T. Schultz.
Public Works, Vol. 109, No. 6, p 83-85, June, 1978. 1 fig.

Descriptors: *Landfills, Pulp and paper industry, *Pulp wastes, *Sludge, *Linings, Infiltration, Permeability, Clays, Fibers(Plants), Municipal wastes, Leachate, Waste water treatment, Industrial wastes.

Papermill waste water sludge was considered as liner and cap material for a new sanitary landfill in Eau Claire, Wisconsin. The former landfill, which received municipal wastes and papermill sludges generated at a rate of 200-250 wet tons/day, was closed because of unsatisfactory geologic conditions. Soil investigations of a 150-acre site selected for the new municipal landfill indicated a shortage of silt and sand for leachate attentuation. The papermill sludges, which were to be disposed of on a 33-acre site, were composed of 54% Kaolin clay and 45% paper fiber with small quantities of alum, activated silica, and polymers. Linings of the municipal landfill with the fairly impermeable papermill sludge would save an estimated $0.5 million over 7 yrs for material transport and liner construction. Full-scale and laboratory tests are currently being conducted to assess the feasibility of papermill sludge as a liner; natural clay is currently the only acceptable lining material. Studies on capping the landfill with the sludge to reduce infiltration have projected a leachate production of 1.19 million gal/yr with an impermeable cap, compared to 2.75 million gal/yr leachate produced by a landfill capped with the available on-site soils. An estimated $100,000 savings has been projected with the use of papermill sludge as a cap rather than imported natural clay; the reduction in leachate from the landfill will also reduce the transportation costs associated with leachate treatment at the waste water treatment plants. Approval of the sludge lining and cap by the Wisconsin Department of Natural Resources is pending the final results of the full-scale tests. (Lisk-FIRL)
W78-09565

THE DEGRADATION OF AN AZO DYE IN AQUEOUS SOLUTIONS BY HIGH-INTENSITY ELECTRON-BEAM IRRADIATION,
Japan Atomic Energy Research, Takasaki. Takasaki Radiation Chemistry Research Establishment.
N. Suzuki, T. Miyata, A. Sakumoto, S. Hashimoto, and W. Kawakami.
International Journal of Applied Radiation and Isotopes, Vol. 29, No. 2, p 103-108, 1978. 10 fig, 2 tab, 8 ref.

Descriptors: *Dyes, *Irradiation, *Spectrophotometry, *Absorption, *Oxygen, Color reactions, Aqueous solutions, Textiles, Salts, Acids, Waste water treatment, Municipal wastes, Analytical techniques, Degradation(Decompositon).

The degradation of Acid Red 265, and azo dye found in textile wastes, by high-intensity electron beam irradiation, was measured under variations in dye concentration, irradiation dose, solution flow rate, and oxygen bubbling rate. Solutions containing 30-240 ppm azo dye were aerated with oxygen before being introduced into the reaction vessel. The reaction vessel was equipped with five reaction cells and a resonance transformer accelerator. Oxygen flow rates during irradiation ranged 0.5-3.0 liters/min; decoloration of the dye was measured by a spectrophotometer at 542 nanometers. At an irradiation dose of 280,000 rads, 100% of the color was removed from a 60 ppm dye solution; decoloration of solutions increased linearly by about 40% with increasing irradiation dose. The oxygen and solution flow rates did not affect the degree of color removal. When nitrogen was bubbled through the solution in place of oxygen, decoloration decreased slightly. The reduction in optical density at 230 nanometers of a 60 ppm solution indicated that 0.5 liter 02/min was insufficient to destroy substituted aromatic rings. An oxygen flow rate of at least 1 liter/min was required to destroy the skeleton of the azo dye molecule. The pH of 30-240 ppm Acid Red 265 solutions decreased with increasing irradiation doses up to 50,000 rad and with oxygen bubbling rather than nitrogen bubbling. (Lisk-FIRL)
W78-09566

RESPIRATORY INHIBITION OF ACTIVATED SLUDGE BY DYES (SENRYO NI YORU KASSEIODEI NO KOKYUSOGAI),
Gifu Univ. (Japan). Dept. of Engineering.
T. Ogawa, Y. Yamada, and E. Idaka.
Seni Gakkai Shi, (Journal of the Socity of Fiber Technology, Japan), Vol. 34, No. 4, p 75-80, 1978. 5 fig, 3 tab, 13 ref.

Descriptors: *Dyes, *Toxicity, *Respiration, *Oxygen demand, *Activated sludge, Microorganisms, Textiles, Inhibition, Alkalis(Bases), Acidity, Alkalinity, Ion exchange, Biochemical oxygen demand, Waste water treatment, Industrial wastes.

The toxicity of textile dye wastes present in municipal treatment plants to microorganisms in activated sludge was evaluated by respiratory inhibition as measured by oxygen uptake rates. Activated sludge microorganisms were incubated at 37C over a 25-hr period in a glucose culture medium having 300 ppm BOD, 100 ppm mixed liquor suspended solids, and a pH of 7.5. Commercial acid, basic, disperse, and direct dyes were added to the cultures at a concentration of 250 ppm and pH 7.5 or 3.6. Basic violet 3 and 7 exhibited the highest toxicity at pH 7.5, inhibiting respiration by 68% and 45%, respectively. The greater respiratory inhibition induced by the basic dyes was alleviated by mixing basic with acid dyes. Little inhibition was evident with disperse dyes at either pH; direct dye inhibition was weaker than acid dye inhibition, which ranged from 2.0-17.0% at pH 7.5. Inhibition by direct dyes averaged 4%. Respiratory inhibition by the dyes was attributed to the ionic interaction of the microorganisms with the dyes. (Lisk-FIRL)
W78-09567

TREATMENT OF WASTEWATER CONTAINING SURFACTANTS (II) - REMOVAL OF SURFACTANTS BY COAGULATION (KAIMENKASSEIZAI GANYU HAISUI NO SHORI (DAI NI HO) - KAKUSHU KAIMENKASSEIZAI NO GYOSHI NI YORU JOKYO),
S. Honda.
Osaka Kogyogijutsu Shikensho Kiho, (Bulletin of the Government Industrial Research Institute, Osaka) Vol. 29, No. 1, p 53-59, 1978. 18 fig, 1 tab, 5 ref.

Descriptors: *Surfactants, *Coagulation, *Chemical precipitation, *Chemical wastes, *Analytical techniques, Anions, Cations, Carbon, Salts, Chemical reactions, Waste water treatment, Industrial wastes.

Aluminum sulfate coagulation of anionic, cationic, nonionic, and amphoteric surfactants was evaluated for optimum pH and in the presence of salts. Surfactants, analyzed, singularly or with co-existing ions, included laurylbetaine, lauryl trimethylammonium chloride, sodium laurylsulfonate, and polyoxyethylene octylphenolether. Following aluminum sulfate coagulation and pH adjustment of the surfactant-bearing waste water, the precipitate was filtered and the uncoagulated surfactant was measured according to the total organic carbon concentration of the filtrate. The optimum pH for coagulation ranged from 5-6; the ratio of coagulant to total organic carbon in solution was 3:10. Coagulation of anionic surfactants by aluminum sulfate removed 70-80% of the surfactants; removal of cationic, nonionic, and amphoteric surfactants by coagulation averaged less than 30%. Binary mixtures of anionic surfactants were reduced by 50-80% in the presence of a co-existing cationic, nonionic, or amphoteric surfactant. Coagulation of surfactants co-existing with salts was tested using NH4Cl, CaCl2, Na2Si03, and (NH4)2HPO4. At the appropriate pH, all co-existing salts except NH4Cl influenced coagulation. (Lisk-FIRL)
W78-09568

HYGIENIC PROBLEMS OF ENVIRONMENTAL PROTECTION FROM THE WASTES OF LIVESTOCK COMPLEXES AND POULTRY FARMS (IN RUSSIAN),
For primary bibliographic entry see Field 5G.
W78-09581

UPGRADING STABILIZATION POND EFFLUENT BY WATER HYACINTH CULTURE,
Texas Dept. of Health, Austin.
R. Dinges.
Journal Water Pollution Control Federation, Vol. 50, No. 5, May, 1978, p 833-845, 6 fig, 10 tab, 15 ref.

Descriptors: *Water pollution treatment, *Waste water treatment, Biological treatment, Oxidation lagoons, *Alage removal, Dissolved solids.

Experiments showed that controlled culture of water hyacinths, Eichhornia crassipes, in shallow basins was effective in removing algae, other suspended particles, and dissolved impurities from stabilization pond effluent. Effluent from the system was low in nitrogen and fecal coliform bacteria. Reduction of BOD5 through the plant and experimental system was 97%, total suspended solids was more than 95%, and COD was about 90%. Hyacinth tissues accumulated chloride, potassium, phosphorus, arsenic, chromium, mercury, iron, lead, nickel, zinc, copper, magnesium and manganese from the basin waters. (Chilton-ORNL)
W78-09594

STORM WATER MANAGEMENT MODEL DEVELOPED BY CIVIL ENGINEERS.
For primary bibliographic entry see Field 5B.
W78-09709

NEW FACILITY HELPS CLEAN UP BOSTON HARBOR.
Water and Sewage Works, Vol. 125, No. 4, p 62-63, April, 1978. 1 fig.

Descriptors: *Storm runoff, *Combined sewers, *Disinfection, *Pumping plants, *Screens, Floods, Storm water, Urban runoff, Pump turbines, Hydraulic equipment, Centrifugal pumps, Channels, Waste water treatment, Municipal wastes.

The $6.7 million Pollution Abatement and Flood Control Facility, constructed by the Boston, Massachusetts, Redevelopment Authority, provides screening and disinfection of storm runoff and combined waste water before discharge into Boston Harbor. The facility contains three, 48-inch, variable speed turbine pumps that are pneumtically controlled and rated at 65,000 gpm each. A 30-inch, electric motor-driven pump and the turbine pumps consist of vertica centrifuge, mixed flow, single-stage, and suction, dry pit-type units. The 1200 hp rated turbines, operated at 600 hp by Saturn turbine units, can accomodate solids up to 7 inches in diameter; the motor-driven pump can accomodate diameters up to 5 inches. The 32-ft vertical shaft speeds of the turbines are reduced to 1,000 rpm followed by a reduction to 395 rpm by Solar and Philadelphia gearboxes. During storm conditions, the electric motor-driven pump is activated when the lvel in the wet well increases to a specified height, followed by the turbines in sequential order. The pumps are equipped with manual override; the fuel oil-powered turbines are still operable in the event of a power failure. Future additions planned for the pumping plant include six detention tanks for solids settling and removal; the water is discharged through the Fort Point Channel to Boston Harbor. (Lisk-FIRL)
W78-09791

5E. Ultimate Disposal Of Wastes

RECLAMATION OF ACIDIC DREDGE SOILS WITH SEWAGE SLUDGE AND LIME AT THE CHESAPEAKE AND DELAWARE CANAL,
Cold Regions and Research and Engineering Lab., Hanover, NH.
A. J. Palazzo.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 636, Price codes: A03 in paper copy, A01 in microfiche. Special Report CRREL-SR-77-19, June 1977. 28 p, 6 fig, 9 tab, 29 ref.

Descriptors: *Soil ammendments, *Sewage sludge, *Lime, *Dredging, *Canals, Grasses, Soil treatment, Metals, Kentucky bluegrass, Fescues, Acidity, Soil chemical properties, Pyrite, Waste water disposal, Sludge disposal, Municipal wastes.

The impact of sewage sludge and lime enrichment of pyritic, acidic dredge soils from the Chesapeake and Delaware Canal was investigated in field studies examining the growth of 29 grasses on the reclaimed soils. A 17-acre area was treated with 45 tons/acre sewage sludge and 10 tons/acre lime applied to a depth of 8 inches. Soil samples at depths of 0-8, 8-16, and 16-24 inches were obtained 20 months after sewage sludge and lime application. The upper soil layer sample had higher pH, cation exchange, exchangeable Ca and Mg, organic C, and P levels when compared to untreated control areas. Total and extractable metals also increased within the 0-8 inch depth. Parameters measured in the lower strata were similar in the control area; Ca and Mg levels were elevated in the lower layer samples. Most of the Zn, Cr, Pb, and Hg was not in a plant-available form; 50% of the Ni and Cd were available to plants and extractable at a concentration of 30.2 ppm. Good growth was observed in Kentucky bluegrass, red fescue, and K-31 tall fescue; the dense groundcover growth of ryegrass hindered the growth of other perennial grasses. Of the seven plant species analyzed for mineral uptake, two types contained Ni concentrations approaching toxicity. (Lisk-FIRL)
W78-09369

USER ACCEPTANCE OF WASTEWATER SLUDGE COMPOST,
Culp/Wesner/Culp, Clean Water Consultants, El Dorado Hills, CA.
W. F. Ettlich, and A. E. Lewis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-272 095, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-77-096, August 1977.

Descriptors: *Sludge treatment, *Sludge disposal, *Surveys, *User rates, *Fertilization, *Transport, Sewage sludge, Financing, Data collections, Cities, Waste water treatment, Municipal wastes.

An investigation of consumer attitudes toward waste water sludge compost utilization and past and current distribution practices was conducted. Interviews were performed with compost users in areas which produce and distribute composted waste water sludge. Usage interviews wer conducted in Placerville, California; Colorado Springs, Colorado; Fort Worth, Texas; Washington, D. C.; Los Angeles, California; and Chicago, Illinois. Results of the interviews indicated a willingness by users to accept composted sludge providing it cost no more than current products and could be tested prior to use. Sludge transportation costs, based on data collected from the Chicago composting operations, were $2.50/cu yd sludge for 28 miles, one way, and $1.30/cu yd for 8 miles, one way. Expected user pick-up of composted sludge in the interviewed areas ranged from 75-100% of the sludge volume produced. (Lisk-FIRL)
W78-09370

STORM SEWAGE: SEPARATION AND DISPOSAL,
For primary bibliographic entry see Field 5D.
W78-09371

OCEAN BAN BUOYS SLUDGE PROCESSES.
Chemical Week, Vol. 122, No. 10, p 38, March, 1978.

Descriptors: *Sludge treatment, *Sludge disposal, *Dewatering, *Drying, *Sewage sludge, Filtration, Centrifugation, Outfall sewers, Waste water treatment, California, Municipal wastes.

The Garver-Greenfield sludge treatment process is being considered for the disposal of sludge by the Los Angeles/Orange County Metropolitan Area Commission. Other alternatives to ocean disposal of sludge, which has been banned by the Environmental Protection Agency, are: transporting sludge to the desert for drying and composting, mechanical dewatering and composting, mechanical dewatering, pyrolyzing, and ocean disposal in deeper trenches. The Garver-Greenfield process is capable of generating fuel; it requires 300 Btus to dewater 1 lb of liquid in sludge, compared to 1,600 Btus/lb of water required by an Organic Recycling recovery process. In the Garver-Greenfield process, sludge is dewatered to 20% solids content on a filter press or centrifuge and mixed with vegetable oil if the sludge will be used as a food supplement or with fuel oil if it is to be incinerated. The sludge with an oil-to-solids ratio of 10:1 undergoes evaporation in multiple-effect units and is separated into solids and oil by settling or centrifuging. More than 90% of the oil is recovered and the liquid fraction is returned to the treatment plant. A 100 ton/day Garver-Greenfield system will cost an estimated $4.5 million or $10.4 million with energy generation for producing electricity. (Lisk-FIRL)
W78-09373

SOME TESTS ON THE MEMBRANE FILTER PLATE,
Severn-Trent Water Authority, Birmingham (England).
B. R. Edmondson, and D. R. Brooks.
Water Pollution Control, Vol. 77, No. 1, p 117-137, 1978. 8 fig, 13 tab.

Descriptors: *Membrane processes, *Filtration, *Sludge treatment, *Membranes, *Drying, *Dewatering, Automation, Optimization, Sewage sludge, Separation techniques, Waste water treatment, Municipal wastes.

A full-scale membrane filter plate press, equipped with two inflatable cloth membrane plates, was tested with sludge from five treatment facilities to

evaluate the increased solids output potential of membrane filter plates over conventional recess plate presses. Under manual operation, the membrane filter plate, producing a 35% dry solids sludge cake that was 32 mm thick, increased the output of three of the treatment plants by 69%, 64%, and 24% for a 24-hr, 5-day/week operation. Automatic operation of the membrane filter plate increased output by 129%, 141%, and 68%. The membrane filter plate reduced the press cycle to 45 min for easily dewatered sludges and controlled the dry solids content by the squeeze time. The membrane filter plate was more adaptable to automation, significantly increasing the output of solids. (Lisk-FIRL)
W78-09380

CENTRAL PIVOT SPRAY SYSTEM CONTROL STORM LAKE POLLUTION,
For primary bibliographic entry see Field 5D.
W78-09382

HOME REMEDY HELPS FIGHT SLUDGE BULKING,
For primary bibliographic entry see Field 5D.
W78-09385

WAUSAU SOLVES DUAL PROBLEM BY USING FILTER PRESS,
Becher-Hoppe Engineers, Inc., Schofield, WI.
For primary bibliographic entry see Field 5D.
W78-09387

UNIQUE SLUDGE HANDLING SYSTEM CHOSEN IN DUBUQUE,
Henningson, Durham, and Richardson, Omaha NE. Environmental Engineering Dept.
J. T. Walker.
Water and Wastes Engineering, Vol. 15, No. 2, p 20-23, February, 1978. 1 fig, 2 tab, 7 ref.

Descriptors: *Sludge treatment, *Centrifugation, *Drying, *Dewatering, *Incineration, Boilers, Sludge disposal, Anaerobic digestion, Landfills, Waste disposal, Trickling filters, Activated sludge, Waste water treatment, Municipal wastes.

A sludge treatment system combining centrifugation, thermal conditioning, vacuum filtration, incineration, and landfill disposal of ash was selected for the Dubuque, Iowa, waste water treatment facility. The system was chosen over six alternatives employing centrifugation, anaerobic digestion, thermal conditioning, vacuum filtration, incinceration, landfill disposal or land application of sludge. Secondary sludge is expected to have a 30% solids content after vacuum filtration and thermal conditioning. About 20% of the primary sludge will receive thermal conditioning and vacuum filtration followed by incineration. Although the dewatered secondary sludge will not require supplementary fuel for incineration, thermal conditioning will use 1.8 million BTU/hr of power. Waste heat operated boilers and coal-fired boilers are being considered as alternatives to gas-fired burners. Effluent is treated by the plant with aerated grease and grit removal, primary settlement, trickling filtration, oxygen activated sludge, final clarification, and chlorination. Primary sludge is vacuum filtered and incinerated in a fluidized bed. Secondary sludge is pumped to an aerated holding tank, centrifuged, thickened, thermally treated with primary sludge, vacuum filtered, and incinerated in a fluidized bed. The plant capacity will be 15 mgd by 1990. (Lisk-FIRL)
W78-09390

CO-DISPOSAL OF SEWAGE SLUDGE USING REFUSE-DERIVED FUEL,
Clinton Bogert Associates, Fort Lee, NJ.
H. L. Kaufman, and L. M. Grillo.
Institute of Environmental Sciences, Technical Meeting, Proceedings, p 204-208, 1978. 4 ref.

Descriptors: *Sewage sludge, *Solid wastes, *Ultimate disposal, *Incineration, *Drying, Energy conservation, Fossil fuels, Biodegradation, Evaporation, Waste water treatment, Sludge treatment, Sludge disposa, Waste disposal, Municipal wastes.

Co-disposal of sewage sludge and refuse-derived fuel (RDF) is considered an economical means of recovering inherent energy in the waste products and reducing the need for fossil fuels. RDF from municipal solid wastes contains as estimated 6,500-7,000 BTU's/lb, compared to raw and digested sludges which have heat values of 12,000 and 10,000 BTU's/lb, repsectively. RDF as a supplementary or primary fuel source costs less than fuel oil and low sulfur coals but produces more ash after incineration of sewage sludge. Thermal disposal of sewage sludge by dewatering and incineration may employ RDF as a supplementary fuel source. RDF can assist in the incineration of sewage sludge in the middle combustion stage of multiple hearth incinerators; co-pyrolysis has also been investigated. Small modifications to the fluidized bed may be made to the allow the use of fossil fuels instead of RDF for combustion of wet sludges. Refuse incinerators may provide hot air for flash-drying sludge at 1,300F to a moisture content of 10-15%. Steam for multiple-effect sludge moisture evaporation in the Carver-Greenfield process may be generated by RDF. Sewage sludge composting with wood chips and suction aeration has been tested at the USDA Agricultural Experimental Station in Beltsville, Maryland; the use of RDF rather than wood chips or other bulking materials would eliminate the final compost-wood chip separation stage because of RDF's biodegradability. (Lisk-FIRL)
W78-09392

THE COMPARISON OF ACTIVATED AND DIGESTED SLUDGE APPLIED TO FLOWERING CHINESE CABBAGE, BRASSICA PARACHINESIS BAILEY,
Chinese Univ. of Hong Kong. Dept. of Biology.
M. H. Wong, and S. W. Yip.
Journal of Environmental Sciences and Health, Vol. A13, No. 3 p, 241-251, 1978. 1 fig, 3 tab, 22 ref.

Descriptors: *Activated sludge, *Sludge digestion, *Vegetable crops, *Heavy metals, *Growth rates, Crop response, Analytical techniques, Soil amendments, Plant growth regulators, Plant tissues, Sludge disposal, Municipal wastes.

Flowering white Chinese cabbage (Brassica parachinensis) was cultivated in activated sludge and digested sludge mixed with garden soil and in garden soil alone. The cabbage seedlings, averaging 2 cm in height, were grown under sludge-to-sandy clay loam ratios of 1:500 and 2:500 dry weight; pH was mantained at 7 by liming. Heavy metal contents in the garden soil and amended soils were measured with atomic absorption spectrophotometry after one week; heavy metal uptake by plant tissues was measured at the end of the growing period. The flowering cabbage exhibited the highest growth rate in the 1:500 activated sludge-soil mixture, reaching a total dry weight after harvesting of 50 g. Plants grown in soil amended with digested sludge achieved a total dry weight growth of 40 g. Higher additions of digested sludge activated sludge did not enhance cabbage growth. At the 1:500 sludge-soil ratio, the edible portion of the plant tissues contained significant levels of Cd, Mn, and Mg when cultivated with activated sludge and high levels of Cd, Mn, and Mg when grown with digested sludge. Plant grown at the 2:500 sludge-to-soil ratio had significant levels of Cd, Cr, Cu, Pb, Mn, and Mg after activated sludge amendements, and significant concentrations of Cd, Pb, Mn, and Mg with digested sludge addition. Although the plants did not exhibit symptoms of heavy metal toxicity, the significant heavy metal uptake by the plants grown with higher ratios of sludge was considered the reason for lower growth. (Lisk-FIRL)
W78-09394

RECLAIMED SEWAGE WATER: A HYDROPONIC GROWTH MEDIUM FOR PLANTS,
California Univ., Los Angeles.
A. Wallace, P. M. Patel, W. L. Berry, and O. R. Lunt.
Resource Recovery and Conservation, Vol. 3, No. 2, p 191-199, May, 1978. 1 fig, 6 tab, 7 ref.

Descriptors: *Crop response, *Hydroponics, *Sewage treatment, *Soil-water-plant relationships, Plant growth regulators, Iron, Trace elements, Nutrient requirements, Greenhouses, Ultimate disposal, Waste water treatment, Municipal wastes, Tomatoes, Lettuce.

Greenhouse crops of chrysanthemum, tomato, egg plant, bell pepper, and lettuce plants were sustained by a hydroponic growth medium of secondary effluent waste water when insoluble iron oxide was applied to the plant roots during transplanting. The test plants were grown hydroponically for 7 weeks in processed and chlorinated-dechlorinated municipal waste water. Plants grown only in the sewage water were iron deficient; tests groups received foliar applications of 4 g/liter iron sulfate or direct root addition of 2-4 g/plant of insoluble iron oxide. The latter treatment produced growth equivalent to plants grown in complete nutrient solutions. An adequate supply of the major nutrients was available to the plants in the waste water; manganese was near the deficiency level in some test plants. Root retention of heavy metals did not cause toxicity to the plant or present a consumer health hazard potential. Acidification of the hydroponic media to pH 7.8, 6.5, 6.0, and 5.0 with sulfuric acid demonstrated that chrysanthemums and tomatoes overcame the iron deficiency problem at pH 5-6; lettuce growth was reduced at pH 5. Acidification increased the trace metal contents in the plants. Results of tests on mature crop response to waste water were comparable to those of greenhouse tests. Flow-through water from the mature crops was used to grow a cucumber crop in the greenhouse study. A two- to six-fold reduction in waste water trace metal concentrations by the mature plants was apparent; it was suggested that this higher quality water could be used for crop irrigation or algae production for cattle feed. (Lisk-FIRL)
W78-09395

LAND TREATMENT: PRESENT STATUS, FUTURE PROSPECTS,
Metcalf and Eddy, Inc., Palo Alto, CA.
C. E. Pound, R. W. Crites, and S. C. Reed.
Civil Engineering-ASCE, Vol. 48, No. 6, p 98-102, June, 1978. 2 tab.

Descriptors: *Ultimate disposal, *Waste water treatment, *Irrigated land, *Soil amendments, *Land reclamation, Infiltration, Percolation, Crops, Operation and maintenance, Cost analysis, Energy conservation, Municipal wastes, Nutrient removal.

Land treatment of municipal waste water is recommended as a cost-effective method of fulfilling the pollution abatement and grant guidelines established by the 1977 Clean Water Act. The Act increased the construction grants to 85% for innovative forms of waste water treatment; an additional 15% of life-cycle costs for these treatment methods is considered competitive with alternative conventional processes. The Clean Water Act encourages energy saving processes; land application conserves about 38,000 kilowatt hrs more annually than an advanced waste water treatment plant. It also supplies nutrients and water to soils and crops. Although capital costs, which are partially funded by the Act, are similar for a 25 mgd advanced treatment plant and a comparable land treatment system, non-fundable operation and maintenance costs are about $2 million/yr more for

advanced treatment than land applications. Operation and maintenance costs of land treatment have been offset by 8-128% in established systems where crops are grown with the waste water applications. Land treatment, such as slow rate irrigation, rapid infiltration, and overland flow, does not produce sludge which requires further treatment. (Lisk-FIRL)
W78-09396

FEED YOUR PLANT LIQUID FERTILIZER,
Bryant-Curington, Inc., Austin, TX.
For primary bibliographic entry see Field 5D.
W78-09401

DESIGN OF DRYING BEDS FOR SURPLUS ACTIVATED SLUDGE,
For primary bibliographic entry see Field 5D.
W78-09410

APPLICATION OF DIGESTED SLUDGE FOR IMPROVING ERODED SOIL CAUSED BY SO2,
Chinese Univ. of Hong Kong. Dept. of Biology.
M. H. Wong, and S. W. Yip.
Journal of Environmental Sciences and Health, Vol. A13, No. 1, p 23-31, 1978. 4 tab, 15 ref.

Descriptors: *Erosion, *Crop response, *Sulfur compounds, *Sewage sludge, *Growth rates, Grasses, Fertilization, Nutrients, Potassium, Phosphorus, Carbon, Red podzolic soils, Yellow podzolic soils, Zinc, Waste water treatment, Sludge disposal, Municipal wastes.

Soils degraded by SO2 emissions from an acid manufacturing plant were conditioned with digested sewage sludge and planted with Agropyron smithii and Buchole dactyloides in a greenhouse trial test. The grasses were grown in: untreated SO2-degraded red-yellow podzol soil; degraded soil treated with 0.5, 1.0, and 1.5 cm digested sludge; and garden soil. The digested sludge had 29.02% organic carbon, 1.96 ppm phosphorus, 41 ppm exchangeable potassium, and a pH of 6.68; the eroded soil contained 1.30% organic carbon, 0.02 ppm phosphorus, and 2.4 ppm exchangeable potassium and had a pH of 4.7. A. smithii and B. dactyloides were grown for 80 days and then harvested. A. smithii cultivated in SO2-degraded soil with sludge applications of 0.5, 1.0, and 1.5 cm grew to heights of roughly 12.55, 15.17, and 17.77 cm/pot, respectively; the untreated SO2-degraded soil and the garden soil yielded growth of 2.12 and 38.25 cm/pot, respectively. B. dactyloides had heights of about 4.76, 9.07, and 14.50 cm/pot in the sludge amended soil; heights of 1.50 and 25.65 cm/pot were attained in the untreated soil and the garden soil, respectively. Grasses grown in the digested sludge treated soil were immature in comparison with the garden soil grown plants, but demonstrated improved growth over those grown in the untreated SO2-degraded sludge. Extractable zinc levels in the sludge were in excess of English agricultural standards. (Lisk-FIRL)
W78-09420

THE EFFECTS OF MADISON METROPOLITAN WASTEWATER EFFLUENT ON WATER QUALITY IN BADFISH CREEK, YAHARA AND ROCK RIVERS,
Texas Univ., Dallas.
For primary bibliographic entry see Field 5C.
W78-09422

REUSE, ENERGY, SLUDGE: IN WHAT DIRECTION ARE WE GOING,
For primary bibliographic entry see Field 5D.
W78-09423

GROWTH AND METAL UPTAKE ON SNAP BEANS GROWN ON SEWAGE SLUDGE-AMENDED SOIL: A FOUR-YEAR STUDY,
Agricultural Research Service, St. Paul, MN.
R. H. Dowdy, W. E. Larson, J. M. Titrud, and J. J. Latterell.
Journal of Environmental Quality, Vol. 7, No. 2, p 252-257, April-June, 1978. 7 fig, 3 tab, 18 ref.

Descriptors: *Beans, *Soil amendements, *Sewage sludge, *Trace elements, *Vegetable crops, Heavy metals, Copper, Zinc, Cadmium, Sands, Soils, Waste water treatment, Anaerobic digestion, Sludge disposal, Municipal wastes.

A four-year study evaluated the trace metal uptake by snap beans (Phaseolus vulgaris) grown in sandy Udorthentic Haploboroll soil amended with anaerobically-digested sludge at total application rates of 350, 700, 1,400 metric tons/ha. Subsequent crops received a single sludge application of 112, 225, or 450 metric tons/ha. Sludge application increased soil pH from 5.3 to a maximum of 6.5; crop yields increased with sludge amendements and often surpassed yields of commercially fertilized control plants. Zn and Cr concentrations in the bean tissue increased with sludge application. An continued to accumulate after the second application and stabilized after the third and fourth applications; Cu uptake levelled off after the initial sludge application. While these concentrations stabilized in the tissue, they did not decrease after sludge treatment was terminated. The concentration of Cd in edible bean tissue never exceeded 0.09 micrograms/g, regardless of the sludge application rate or schedule. Zn and Cu concentrations also increased in the leaf portion of the plants after sludge application. (Lisk-FIRL)
W78-09439

ASSESSMENT AND SIGNIFICANCE OF SEDIMENT-ASSOCIATED OIL AND GREASE IN AQUATIC ENVIRONMENTS,
Naval Biosciences Lab., Oakland, CA.
L. H. DiSalvo, H. E. Guard, N. D. Hirsch, and J. Ng.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A050 044, Price codes: A08 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-26, November 1977. 148 p, 35 tab, 8 fig, 1 append, 173 ref.

Descriptors: *Aquatic environments, *Oil, *Wastes, Sediments, *Bibliographies, *Dredged material disposal, *Greases, Reviews.

A review of the literature suggests that the term 'oil and grease', as used in descriptive and regulatory context for dredged material disposal, is a broadly based term defined by the methodology used in its determination. Oil and grease contains numerous natural and petroleum derived hydrocarbons, plus fats, oil, and waxes of both natural and anthropogenic origin. Also included in oil and grease are trace quantities of fat-soluble materials such as DDT and PCB. Elemental sulfur is a contaminant often included in oil and grease determinations by virtue of its solubility in some organic solvents. Experimental studies using dredged material contaminated with oil and grease show low toxicity for mussels, clams, crabs, and snails. Minor uptake of hydrocarbons into organism tissues occurred, compared with levels of contaminants in the dredged material tested. In test periods lasting up to 30 days, very little biodegradation of oily residues occurred, suggesting the oil and grease value to be of little use in the prediction of BOD loading. Evaluation of the standard elutriate test with regard to oil and grease suggested this test to be of little value as the small amounts of oil released from the sediments were rapidly absorbed to the walls of the test vessels. (WES)
W78-09468

FIELD STUDY OF THE EFFECTS OF STORMS ON THE STABILITY AND FATE OF DREDGED MATERIAL IN SUBAQUEOUS DISPOSAL AREAS,
Yale Univ., New Haven, CT. Dept. of Geology and Geophysics.
H. J. Bokuniewicz.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-22, November 1977. 87 p, 32 fig, 1 append, 2 tab, 24 ref.

Descriptors: *Estuaries, *Storms, On-site investigations, Sediments, New York, *Long Island Sound(NY), *Dredged material disposal, *Waste disposal sites, *Subaqueous disposal areas.

Long Island Sound is a large estuary. Dredged sediment placed on the bottom of the Sound is subject to dispersion by the tidal stream, estuarine circulaton, waves, and disturbances of the hydraulic flow field by storms. Repeated bathymetric surveys of a deposit of dredged material at the New Haven disposal site show that after initial self-consolidation of the mound, no significant changes in pile configuration occurred over a three-year period; erosion of the deposit is not detected. The data obtained show that to best contain silt-clay dredged material, the disposal site should be on a naturally accreting mud bottom, the disposal operation should emplace a large volume of material on the site expeditiously, and the deposit should be built to an optimum configuration. The capacity of the disposal site is limited by the maximum height of the disposal mound and the maximum slope of the pile sides which present a minimum disturbance of the natural hydraulic regime. The capacity of the New Haven site is estimated to be up to 1.7 x 10 to the 6th power yd3 of unarmored, silty, dredged material. Larger volumes may be contained if the surface of the deposit is armored with coarser material. (WES)
W78-09471

AN ASSESSMENT OF PROBLEMS ASSOCIATED WITH EVALUATING THE PHYSICAL, CHEMICAL AND BIOLOGICAL IMPACTS OF DISCHARGING FILL MATERIAL,
Oklahoma Univ., Normal. School of Civil Engineering and Environmental Science.
L. W. Canter.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 519, Price codes: A11 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-29, December 1977. 236 p, 7 append, 36 tab, 83 ref, 3 fig.

Descriptors: *Dredged material, *Environmental effects, Evaluation, *Chemicals, *Biological impact, *Fill materials, Waste disposal.

Fill materials can be natural (soil, rock, or sand) or man-altered (dredged material, solid wastes, or residues), with projects involving usage including property protection, causeway/roadfills, and site development. Potential environmental impacts are regulated by permits based on Section 404 of PI92-500. This study focused on problems associated with evaluating environmental changes resulting from fill material discharges. A weighted-rankings technique was used to establish priorities of permitting (administrative) concerns and technical deficiencies. A literature survey was conducted to determine technical deficiencies. Potential physical impacts found include changes in infiltration and flow regimes, destruction/alternation of natural or man-made habitats, and creation of habitats. Chemical impacts were found to result from the release of suspended solids, organics, nutrients, and toxic substances. Biological impacts ranged from physical barriers to fish migration to complete 'smothering' of entire wetland areas. The effects of leachates on aquatic biota were found to be complex and diverse, ranging from no measurable changes to acute toxicity. (WES)
W78-09472

FIELD STUDY TO DETERMINE THE FEASIBILITY OF ELECTRO-OSMOTIC DEWATERING OF DREDGED MATERIAL,
Army Engineer District, Mobile, AL.
C. E. O'Bannon.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A048 566, Price codes: A04 in paper copy, A01 in microfiche. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Miscellaneous Paper D-77-2, November 1977. 65 p, 9 tab, 22 fig, 11 ref.

Descriptors: *Dewatering, *Electro-osmosis, On-site investigations, Waste treatment, *Dredged material, Waste disposa sites.

Removing water from in-place dredged material would increase the capacity of disposal sites for deposition of additional material and a variety of other purposes. To accomplish dewatering of in-place dredged material economically and within a reasonable period of time, research was conducted to determine the feasibility of using electro-osmosis. The process of electro-osmosis is used in soil stabilization work and entails passing low-level electrical energy through soil. Water associated with positive ions in a solution migrates to a negative electrode and is there removed from the soil mass. The test site was divided into four sections, each contaning a single cathode discharge well and two anodes. Coke-breeze with electrode inserts was used for anodes and cathodes in two of the sections and slotted steel casings with steel rods, pipes, or rails were used in the other two sections. Electrode spacing was 6.1 and 12.2 m. The section consisting of railroad rail and slotted steel pipe electrodes on the 6.1-m spacing was the most efficient. However, the cost per cubic meter of water removed for this best section was $21.20. Coke-breeze anodes and chlorine resistant electrodes and slotted steel pipe cathodes are recommended for future implementation. (WES)
W78-09473

FEASIBILITY OF PINTO ISLAND AS A LONG-TERM DREDGED MATERIAL DISPOSAL SITE,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
T. A. Haliburton, P. A. Douglas, and J. Fowler.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A050 331, Price codes: A04 in paper copy, A01 in microfiche. Miscellaneous Paper D-77-3, December 1977. 53 p, 2 tab, 1 append, 11 fig.

Descriptors: *Feasibility studies, *Alabama, *Dredged material disposal, *Pinto Island(Ala), *Waste disposal sites.

This study was a cooperative effort by the U. S. Army Engineer District, Mobile (MDO) and the U.S. Army Engineer Waterways Experiment Station (WES) to illustrate application of technology developed by the Dredged Material Research Program (DMRP), administered by WES, in solution of field element problems. The study sought to determine if a site on Pinto Island, near Mobile, Alabama, could be used as a long-term disposal facility to contain maintenance dredging material from the Mobile River. Survey data, foundation characterization, and background data were provided by MDO, while evaluation and assessment were conducted by WES. Using DMRP-developed concepts, plans were developed for optimum use of the site, including details of sequential construction, dredged material dewatering, and productive use of dewatered dredged material. Two alternate disposal area configurations to provide adequate capcity through the year 2007 and through the year 2019 are proposed for consideration by MDO. For each alternative, total costs of disposal area construction, operation, and maintenance are estimated to be approximately $0.40 per cubic yard of storage capacity. Appendix A presents a preliminary design for the Pinto Pass dikes. (WES)
W78-09474

AN EVALUATION OF PROGRESSIVE TRENCHING AS A TECHNIQUE FOR DEWATERING FINE-GRAINED DREDGED MATERIAL,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
M. R. Palermo.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 687, Price codes: A09 in paper copy, A01 in microfiche. Miscellaneous Paper D-77-4, December 1977. 174 p, 5 append, 61 fig, 39 pl, 9 tab, 30 ref.

Descriptors: *Dewatering, *Dredging, *Surface drainage, Consolidation, *Alabama, *Trenching, *Dredged material, *Polecat Bay(Ala), Riverine utility craft, Waste disposal site, Fine grained soils.

The results of a study conducted within a confined disposal area concerning the effects of progressive trenching on dredged material dewatering and drying are documented. The study consisted of an initial field and laboratory testing program, construction of a surface drainage system within the disposal area using a progressive trenching approach, evaluation of trenching equipment, and a field instrumentation and monitoring program. Effects of the progressive trenching efforts were evaluated by monitoring dredged material surface elevations and dredged material groundwater elevations within the study area. Field data indicated that the surface drainage system was effective in lowering the dredged material groundwater table. An average surface settlement of approximately 0.75 ft was achieved throughout the study area. Economic evaluations indicated that progressive trenching operations were economically feasible with both comparatively low unit and favorable benefit/cost ratio. (WES)
W78-09476

AQUATIC DISPOSAL FIELD INVESTIGATION, GALVESTON, TEXAS, OFFSHORE DISPOSAL SITE; APPENDIX A: INVESTIGATION OF THE HYDRAULIC REGIME AND PHYSICAL NATURE OF SEDIMENTATION,
Moody Coll. of Marine Sciences and Maritime Research, Galveston, TX. Dept. of Marine Sciences.
E. L. Estes, and R. J. Scrudato.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-20, December 1977. 155 p, 1 append, 11 tab, 78 fig, 24 ref.

Descriptors: *Water quality, *Sedimentation, *Gulf of Mexico, On site investigation, Texas, Sediments, *Galveston Bay, *Dredged material disposal, *Hydraulic regimen, Waste disposal sites.

The results are presented of a multifaceted investigation of the geological processes of deposition, erosion, and transport of dredged material within the area of Galveston offshore Dredged Material Disposal Site (DMDS) during the period 6 March 1975-20 November 1976. This study involved two major phases: a pilot study designed to rapidly survey the DMDS and environs, and an experimental study to delineate natural changes in the physical and geological characteristics of the study area after disposal had occurred. The latter study involved the monitoring of dredged material disposal at selected locations to determine the physical-geological processes active. Control sites were also monitored for comparison. Hydrographic data were collected to delineate current and wave effects within the DMDS, and flume experiments were conducted to determine the hydrodynamic characteristics of dredged material placed in the area. Available data indicate that dredged material has been eroded from the shallow water portion of the DMDS and has been transported in a downcoast-offshore direction; little erosion was noted in the deeper, offshore disposal sites. (See also W78-09483) (WES)
W78-09482

AQUATIC DISPOSAL FIELD INVESTIGATION, GALVESTON, TEXAS, OFFSHORE DISPOSAL SITE; APPENDIX B: INVESTIGATION OF WATER-QUALITY PARAMETERS AND PHYSICOCHEMICAL PARAMETERS,
Texas Univ. at Dallas, Richardson. Inst. for Environmental Sciences.
G. F. Lee.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-20, December 1977. 155 tab, 435 p, 51 fig, 55 ref.

Descriptors: Aquatic environment, Environmental effects, Water quality, *Gulf of Mexico, Sediments, Dredging, Texas, *Galveston Bay(Tex), *Dredged material disposal, Physicochemical parameters, Waste disposal sites.

A study has been conducted on the environmental impact of the chemical contaminants present in dredged sediments which were dumped at a site in the Gulf of Mexico approximately five miles offshore of Galveston, Texas. Sediments from the Galveston Bay Entrance Channel and the Texas City Channel Turning Basin were dredged with a hopper dredge and dumped at the offshore disposal site. A series of pre-disposal surveys was conducted to establish background data on the characteristics of the disposal site water column and sediments. Nine dumps of dredged sediments were monitored, with sampling sites generally located 100 to 200 meters downcurrent from the dump sites. Postdisposal surveys were conducted to determine if the chemical contaminants present in the disposed sediments had residual effects on the water quality. The heavy metals, copper, cadmium, mercury, lead, nickel, zinc, chromium, iron, manganese, and arsenic; aquatic plant nutrients, such as nitrogen and phosphorus compounds; toxicants; and other parameters, such as oxygen demand and sulfide were monitored before, during and after disposal. (See also W78-09482) (WES)
W78-09483

AQUATIC DISPOSAL FIELD INVESTIGATIONS, COLUMBIA RIVER DISPOSAL SITE, OREGON; APPENDIX A: INVESTIGATION OF THE HYDRAULIC REGIME AND PHYSICAL NATURE OF BOTTOM SEDIMENTATION,
Washington Univ., Seattle. Dept. of Oceanography.
R. W. Sternberg, J. S. Creager, W. Glassley, and J. Johnson.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-30, December 1977. 400 p 69 ref, 133 fig, 2 pl, 2 append.

Descriptors: *Bottom sediments, On-site investigations, Sedimentation, Oregon, *Columbia River(Ore), *Hydraulic regimen, *Dredged material disposal, Waste disposal sites.

A two-part study was conducted in a region seaward of the Columbia River where disposal of large quantities of dredged material has occurred over the last several decades. The first part included repeated bathymetric surveys and sampling for distribution and seasonal variations of sediment texture and mineralogy throughout the study area, and especially at designated disposal sites. Near-bottom hydraulic conditions (waves, tides, currents, turbidity) were also measured at several sites and during all seasons. The second part was related to an experiment in which 600,000 cu yd of material dredged from the Columbia River estuary were dumped at a specially designated site, which was monitored before, during, and after disposal. The objectives of the sedimentological aspects of the study were to identify and map all deposits of dredged material and to recognize seasonal and long-term changes. The objectives of the hydraulic aspects were to document the ambient near-bot-

tom conditions, and their effect on the deposit at the experimental site. The coherent and complementary nature of the results emphasizes the value of combining both descriptive sedimentological techniques and measurements of oceanic processes for monitoring and predicting the fate of dredged material. (WES)
W78-09484

AQUATIC DISPOSAL FIELD INVESTIGATIONS, DUWAMISH WATERWAY DISPOSAL SITE, PUGET SOUND, WASHINGTON; APPENDIX C: EFFECTS OF DREDGED MATERIAL DISPOSAL ON THE CONCENTRATION OF MERCURY AND CHROMIUM IN SEVERAL SPECIES OF MARINE ANIMALS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
F. M. Teeny, and A. S. Hall.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-24, November 1977. 22 p, 8 tab, 22 ref.

Descriptors: *Chromium, Marine animals, *Mercury, Aquatic environment, *Environmental effects, Washington, Duwamish Waterway(Wash), *Puget Sound(Wash), *Dredged material disposal, Waste disposal sites.

Specimens of five species of marine organisms indigenous to Puget Sound were collected over a period of nine months for mercury and chromium analysis. The specimens were collected from two environmentally similar sites in Elliott Bay, the disposal site for 'polluted' dredged material from the Duwamish Waterway and a reference or control site. Mercury and chromium concentrations in English sole (Parophrys vetulus), Alaska and Oregon pink shrimp (Pandalus borealis and P. jordani), spot shrimp (Pandalus platyceros), sea cucumber (Parastichopus californicus), and mussel (Mytilus edulis) were not significantly different between the two sites. In all samples, the levels of mercury and chromium were low and did not exceed 0.10 ppm for mercury and 0.91 ppm for chromium. These data suggest that the disposal operation had no apparent effect upon the mercury and chromium concentrations in the five species of organisms studied. (WES)
W78-09485

AQUATIC DISPOSAL FIELD INVESTIGATIONS, EATONS NECK DISPOSAL SITE, LONG ISLAND SOUND; APPENDIX B: WATER-QUALITY PARAMETERS AND PHYSICOCHEMICAL SEDIMENT PARAMETERS.
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-6, January 1978. 329 p, 2 append, 94 ref, 113 fig, 18 tab.

Descriptors: Water quality, Aquatic environment, *Sediments, *Waste disposal, On site investigations, New York, *Eaton's Neck(NY), *Long Island Sound(NY), *Sediment sampling, Waste disposal sites.

Seven oceanographic cruises and three sediment coring cruises, which took place between October 30, 1974, and May 29, 1975, were conducted in western Long Island Sound to assess the baseline water column and sediment properties near the Eatons Neck disposal site. The following points summarize our main findings: (1) Seasonal spatial distributions of NH4+ and NO3- show that both the East River as well as the lateral embayments are important nitrogen sources to the western portion of Long Island Sound. (2) Increased water column stability coincided with increased chlorophyll a concentration. (3) Seasonal depth and water column averages of NH4+ and NO3- showed nitrogen depletion in the surface layer. (4) Observed seasonal concentrations of NO3- were similar to those measured by Gordon Riley (1955), but higher concentrations occurred later in the year, as did the phytoplankton bloom. (5) Observed PO43- concentrations were seasonally elevated over those determined by Gordon Riley (1955) by about 1 micrometer. (See also W78-02782 thru W78-02785 and W78-09487) (WES)
W78-09486

AQUATIC DISPOSAL FIELD INVESTIGATIONS, EATONS NECK DISPOSAL SITE, LONG ISLAND SOUND; APPENDIX C: PREDISPOSAL BASELINE CONDITIONS OF BENTHIC ASSEMBLAGES,
New York Ocean Science Lab., Montauk.
D. K. Serafy, D. J. Hartzband, and M. Bowen.
Army Engineer Waterways Experiment Station, Vicksburg, Mississippi, Technical Report D-77-6, November 1977. 238 p, 11 tab, 4 append, 11 fig, 96 ref.

Descriptors: *Benthos, *Marine animals, On-site investigations, New York, *Eaton's Neck(NY), *Long Island Sound(NY), *Dredged material, *Waste disposal sites.

A baseline survey of macrobenthic and meiobenthic assemblages inhabiting the Eatons Neck Disposal Site and immediate vicinity of western Long Island Sound was conducted from October 1974 through June 1975. The data were used to describe the benthic assemblages of a disposal site that had received dredged material and other substances for a period of about 71 years, 1902 to 1973. No dumping had taken place at the site for about one year prior to collection of the baseline data. The mud assemblage generally had lower species diversity, biomass, and density of macroinvertebrates than the two sand assemblages. Deposit feeders were typically the most abundant species in all assemblages. Temporal changes occurred in benthic species composition and abundance. The meiobenthos was dominated by nematodes and harpacticoid copepods. (See also W78-02782 thru W78-02785 and W78-09486) (WES)
W78-09487

DEWATERING AND DISPOSAL OF BIOLOGICAL SLUDGE (ENTWAESSERUNG UND BESEITIGUNG VON BIOLOGISCHEM SCHLAMM),
Hannoversche Papierfabriken Alfeld (West Germany).
M. Hottmann.
Das Papier, Vol 31, No 10A, p V98-V101, V104-V108, November, 1977. 1 tab. English summary.

Descriptors: *Sludge treatment, *Sludge disposal, *Pulp wastes, *Biological treatment, Wastes, Industrial wastes, Water pollution sources, Sludge, Solid wastes, Dewatering, Recycling, Pulp and paper industry, Disposal, Waste disposal, Ultimate disposal, Oxidation.

Treatment and disposal of sludge resulting from paper-mill effluents are just as important as effluent purification itself. Biological sludges are harder to handle than mechanical-chemical sludges, but satisfactory dewatering is possible with adequate machines and proper conditions. The main problem is disposal of the sludge. Recycling into the production line or as a raw material for new products are possibilities in some plants, but usually it has been dumped. Antipollution standards and regulations are making this more difficult. New disposal methods must be found. High-pressure wet oxidation may make recycling of fillers possible. (Ward-IPC)
W78-09503

REUSE OF ASH FROM EFFLUENT SLUDGES (WIEDERVERWENDUNG DER ASCHE VON ABWASSERSCHLAEMMEN),
Technische Hochschule, Darmstadt (West Germany). Inst. fur Papierfabrikation.
L. Gottsching, G. Hennings, and H.-L. Dalpke.
Wochenblatt fur Papierfabrikation, Vol. 105, No. 23/24, p 953-960, December 15, 1977. 10 fig, 1 illus, 34 ref, 1 tab. English summary.

Descriptors: *Pulp wastes, *Sludge disposal, Sludge treatment, Wastes, Industrial wastes, Water pollution sources, Pulp and paper industry, Clays, Titanium, Calcium carbonate, Color, Pigments, Solid wastes, Abrasion, Reflectance, Sludge, Kaolin, Titanium dioxide, Ash, Talc, Blanc fixe.

Sludges from paper mill effluents contain appreciable amounts of fillers and clays which might possibly be recovered and reused. Laboratory tests involving industrial conditions of sludge combustion (800-1000 C) show that kaolin is irreversibly altered, precluding reuse after such recovery. Titanium dioxide is not altered, but is not readily separable. Ash rich in titanium might be used to replace ilmenite for producing titanium pigment. Laboratory tests involving wet oxidation at 275C and about 200-300 atmospheres pressure did not change reflectance, color, or abrasiveness of kaolin, coating clay, calcium carbonate, blanc fixe, or talc. Ash so recovered might possibly be reused as filler or paper coating pigment. (Ward-IPC)
W78-09515

TREATMENT OF PLATING WASTES FROM THE AUTOMOTIVE INDUSTRY,
For primary bibliographic entry see Field 5D.
W78-09559

LANDFILL RECYCLES WASTE PAPERMILL SLUDGE,
Ayres (Owen) and Associates, Inc., Eau Claire, WI.
For primary bibliographic entry see Field 5D.
W78-09565

A PRELIMINARY ASSESSMENT OF THE EFFECTS OF SUBSURFACE SEWAGE SLUDGE DISPOSAL ON GROUNDWATER QUALITY,
Environmental Protection Agency, Washington, DC. Office of Solid Waste Management Program.
For primary bibliographic entry see Field 5C.
W78-09572

HEAVY METALS CONTAINED IN RUNOFF FROM LAND RECEIVING WASTES,
Minnesota Agricultural Experiment Station, St. Paul.
For primary bibliographic entry see Field 5B.
W78-09573

THE DISPOSAL OF RADIOACTIVE WASTE IN ICE SHEETS,
K. Philbreth.
In: Symposium on Applied Glaciology; Proceedings of the Fourth Symposium on Glaciology, Cambridge (England), September 13-17, 1976. Journal of Glaciology, Vol. 19, No. 81, p 607-617, 1977. 3 fig, 34 ref.

Descriptors: *Radioactive waste disposal, *Antarctic, *Arctic, *Ice, Waste disposal, Waste storage, Radioactive wastes, Strontium, Cesium, Radioisotopes, Climates, Safety, Temperature, Mathematical models, Melting, *Greenland, Ice sheets, Isotope half life.

The waste containers should be retrievable for a few centuries until further research has solved all problems and 90Sr and 137Cs have decayed to less than 0.1%. Safe and fairly cheap retrievability can be guaranteed without container mooring. The paper presented an example: The high-level waste of the whole world for the next 30 years could be put into 3 x 10 to the 7th power spherical containers with 0.2 m radius and disposed of in an area

with 15 km radius and a depth range of 20-100 m under the surface of either the Antarctic or the Greenland ice sheet. The deposit does not affect the stability of the sheet. Even the most upsetting natural ice-sheet instabilities and/or climatic changes could not cause radioactive contamination. (See also W78-09603) (Humphreys-ISWS)
W78-09647

PREDICTING SOLUTE TRANSPORT IN SUBSURFACE WATERS,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W78-09752

5F. Water Treatment and Quality Alteration

CHEMICAL AND PHYSICAL QUALITY OF SELECTED PUBLIC WATER SUPPLIES IN FLORIDA, AUGUST-SEPTEMBER 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-09320

FILTERING SYSTEM FOR FISH-FARMING WATER,
Y. Kato.
U.S. Patent No. 4,067,809, 14 p, 19 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 966, No. 2, p 669, January 10, 1978.

Descriptors: *Patents, *Fish farming, Aquiculture, Filters, *Filtration, Equipment, Water quality control, Aerobic bacteria, Aerobic conditions, Oxygen, *Water treatment.

A filtering system is disclosed for effectively filtering the water of aquariums for tropical or saltwater fish, the water of fish-farming ponds, and/or any other type of fish-farming water. The system comprises the partitioning of a filtration tank into a storage chamber and a filtration chamber and the provision within the filtration chamber of filters and vacancies which allow the water to pass through. An open space is provided above the filters and vacancies, and the water level of the storage chamber is maintained lower than the top of the filters within the filtration chamber. When the fish-farming water is supplied into the storage chamber via a lift pipe, droppings, leftover feed, and other dirt is allowed to enter but simultaneously oxygen from the atmosphere is admixed so as to prevent the inside from becoming anaerobic and to enhance the propagation of aerobic bacteria. Thus, the water in the storage tank is pre-purified by the deposition of activated sludge formed by means of the decomposition of the dirt by the aerobic bacteria. At the same time, dirt coming into the filtration chamber is controlled so as to reduce the causes for clogging. In the filtration chamber, a filter film of aerobic bacteria and activated sludge is formed upon the surfaces of the filters and effectively purifies the water passing through. The discharge chamber is equipped with a discharge pipe which has an opening directed along the surface of the water, and in this manner, the fish-farming water is purified in the storage chamber, further purified in the filtration chamber and discharged to uniformly circulated. (Sinha-OEIS)
W78-09427

METHOD OF DESTROYING PYROGENS,
American Sterilizer Co., Erie, PA. (Assignee).
D. A. Gunther.
U.S. Patent No. 4,069,153, 4 p, 6 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 966, No. 3, p 1115, January 17, 1978.

Descriptors: *Patents, *Water treatment, *Water purification, Water quality control, *Ultraviolet radiation, Filtration, Potable water, Viruses, Bacteria, *Pyrogens.

Pyrogens refer to microbial endotoxins capable of producing fever in mammals and are metabolic products of certain microorganisms chemically classified as lipopolysaccharides. Given a supply of suitable water, the disclosed system provides a totally safe system utilizing submicron filtration to remove bacteria, utilizes an intense source of high energy ultraviolet light in a specially designed flow cell to destroy pyrogenicity and organisms such as viruses, that are not retained by the filter. Asepsis of the drawoff point is maintained by ultraviolet radiation, enhanced by ozone produced by the ultraviolet source. Ultraviolet sources of appropriate energy and intensity are known to be available and are effective, since the noxious agents absorb this energy and are internally destroyed or inactivated; in addition, the high energy state produced in the water by its absorbtion and peroxide formation enhance inactivation. (Sinha-OEIS)
W78-09435

SOME PROBLEMS IN ORGANIZING THE ARTIFICIAL FLUORINATION OF DRINKING WATER IN THE FAR NORTH (IN RUSSIAN),
Sanitarno-Epidemiologicheskaya Stantaiya, Kandalaksha (USSR).
V. P. Chashchin, and T. A. Zemtsova.
Gig Sanit (4), p 81-83, 1977.

Descriptors: Fluorosis, Kandalaksha, Murmansk, Oblast, Pollution, Russian-SFSR, USSR, *Fluorination, *Water treatment, *Potable water.

Results of some studies conducted during the preliminary planning of drinking water fluorination in the city of Kandalaksha in the Murmansk Oblast (Russian SFSR, USSR) are presented. Analysis of the effect of F in the form of atmospheric pollution (aluminum plant) were done in a region of the city where the atmospheric concentration of inorganic F compounds was equivalent to or higher than optimal drinking water concentration (1-1.8 mg/l). The atmospheric F did not affect the overall incidence of caries (almost 100%) in the schoolchildren studied. The excess F resulted in increased F excretion, reduced intensity of caries per person and isolated cases of fluorosis. Water fluorination in such areas should be preceded by air pollution control measures. The water consumption levels and working conditions (moderate overheating of the body) of certain occupational groups must also be considered in the preliminary planning of water fluorination. Yet another problem is the sorption of F by water pipes as the distance from the fluorination source increases.--Copyright 1978, Biological Abstracts, Inc.
W78-09505

EXPERIENCE IN THE STUDY OF DENTAL CARIES AMONG THE POPULATION AND FLUORIDE CONTENT IN DRINKING WATER (IN RUSSIAN),
M. I. Kobrinskaya, M. S. Kobrinskii, R. M. Sevch, N. V. Zheleznyak, and M. S. Lesnoi.
Gig Sanit (5) p 91-92, 1977.

Descriptors: *Water quaity standards, *Dental caries, *Potable water, *Fluorides, Statistics, Water treatment.

Statistical analysis of the incidence of dental caries in 143 pre-school chlidren and 645 workers, and of fluoride content in 270 water samples from 19 separate population centers revealed that the incidence of caries fluctuated from 31-42% in 1971-75. The highest concentration of fluoride found in fresh drinking water was 0.67 mg/l, or 2 times lower than government standards. In the majority of drinking water samples the fluoride level fluctuated from 0 to 0.57 mg/l.--Copyright 1978, Biological Abstracts, INc.
W78-09513

THE USE OF ELECTROLYZED SOLUTIONS OF COMMON SALT FOR WATER DECONTAMINATION (IN RUSSIAN),
Saratovskii Gosudartsvennyi Meditsinskii Inst. (USSR).
E. V. Shtannikov, and Ya. M. Morozov.
Gig Sanit (8), p 15-19, 1977.

Descriptors: *Botulin, Chlorine oxides, Sodium chloride, Toxins, *Electrolysis, *Water treatment, Salts, Chlorination.

The effectiveness of botulin toxin inactivation in water by electrolyzed salt was studied. Toxin destruction processes produced by Cl compounds and the NaCl electrolysis products appeared to be similar. A method of increasing the activity of chlorine oxides by changing the electrolysis regimen with ionite membranes is suggested.--Copyright 1978, Biological Abstracts, Inc.
W78-09585

SOLE OR PRINCIPAL SOURCE AQUIFER AREAS.
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
For primary bibliographic entry see Field 5G.
W78-09695

PUBLIC WATER SUPPLIES OF NORTH CAROLINA, A SUMMARY OF WATER SOURCES, USE, TREATMENT, AND CAPACITY OF WATER-SUPPLY SYSTEMS,
Geological Survey, Raleigh, NC. Water Resources Div.
L. T. Mann, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 047, Price codes: A04 in paper copy, A01 in microfiche. Water-Resources Investigations 78-16, April 1978. 61 p, 2 fig, 3 tab, 6 ref.

Descriptors: *Water supply, *North Carolina, *Surface waters, *Groundwater, *Distribution systems, Water treatment, Water quality, Water sources, Water storage, Water utilization.

Data were collected during 1970-76 on 224 public water supply systems in North Carolina with 500 or more customers. This report summarizes these data that were previously published in five separate regional reports. The data are presented in order to Council of Government region, county, and water system name and include population served, average and maximum daily use, industrial use, water source, allowable draft of surface-water supplies, raw water pumping capacity, raw and finished water storage, type of water treatment, treatment plant capacity, and a summary of the chemical quality of finished water. Tables and maps provide cross references for system names, counties, Council of Government regions and water source. (Woodard-USGS)
W78-09753

5G. Water Quality Control

EFFECTS OF IRRIGATION ON WATER QUALITY IN THE SAND PLAIN OF CENTRAL WISCONSIN,
Geological Survey, Madison, WI. Water Resources Div.
For primary bibliographic entry see Field 5B.
W78-09306

RECLAMATION OF ACIDIC DREDGE SOILS WITH SEWAGE SLUDGE AND LIME AT THE CHESAPEAKE AND DELAWARE CANAL,
Cold Regions and Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 5E.
W78-09369

CHICAGO PIONEERS IN CORRECTING WATER POLLUTION, CONTROLLING FLOODS.
For primary bibliographic entry see Field 5D.
W78-09375

CONTROLLING IMPOUNDMENTS WHICH MAY POLLUTE GROUNDWATER,
Maryland Water Resources Commission, Annapolis. Permits Div.
A. Schiffman.
Water and Sewage Works, Vol. 125, No. 1, p 62-64, 66-67, January, 1978.

Descriptors: *Oxidation lagoons, *Sewage, *Storage, *Linings, *Leakage, Industrial wastes, Plastics, Construction materials, Chloride, Nitrates, Waste water treatment, Municipal wastes.

Problems associated with groundwater contamination by impoundments storing municipal and industrial wastes are reviewed. A leak in one of two oxidation lagoons, lined with reinforced rubber on tar-impregnated fiber mats on top of rock, was undetected by a water level counter and was found only when lagoons were drained. Leakage from sewage oxidation lagoons, occupying 180 acres and receiving municipal wastes and sodium chloride pickling brine, contaminated groundwater within a 1,000 ft zone with chloride levels up to 220 mg/liter. Chloride levels near the pickling plant ranged up to 1,690 mg/liter in domestic drinking wells and 6,300 mg/liter in a plant well. Chloride was found at a depth of 75 ft, 400 ft from brine and pickling tanks. Leakage in two covered, polyvinyl chloride membrane-lined storage lagoons for liquid nitrogen increased nitrate-nitrogen concentrations to as high as 27 mg/liter at a distance 50 ft from the ponds. Plating waste leakage from a storage lagoon contaminated water 1000 ft from the site to a depth of 50 ft. Groundwater was not contaminated; chromium and other metals had coated sand, silt, and clay horizons at a depth between 20-45 ft. Phenolic wastes stored in a clay-lined lagoon leaked to a depth of 9 ft, producing stream and groundwater phenol concentrations of 2.1 mg/liter and 14.4 mg/liter, respectively. (Lisk-FIRL)
W78-09419

WATER REORGANIZATION--AIMS, ACHIEVEMENT AND THE FUTURE,
Thames Water Authority, London (England).
C. S. Sinnott.
Effluent and Water Treatment Journal, Vol. 18, No. 2, p 73, 76-77, 79, February, 1978.

Descriptors: *River basin development, *River basin commissions, *Watershed management, *Treatment facilities, *Comprehensive planning, Activated sludge, Rivers, Pumping plants, Nitrification, Water supply, Waste water treatment, Municipal wastes.

Improvements in waste water quality enacted by England's Thames Water Authority since its inauguration in 1974 are reviewed. An 8,300 million gallon reservoir, completed in 1976, and the Lambourn valley groundwater plan augmented the water supplies during a drought. A complete sewage treatment plant was constructed at Beckton to improve the quality of effluent flowing into the Thames River. Carrousel waste water treatment systems were installed in Ash Vale and Shroncote to assist the overloaded treatment plant in Farnborough, Hampshire. Secondary treatment operations were installed in the Long Reach works where treated effluent was polluting an estuary. High nitrate concentrations in the Lee River, supplying 7% of the water the Thames region, were reduced by constructing a denitrifying plant at Luton Sewage Treatment Works and converting an activated sludge plant to reduce nitrates at Rye Meads. A total of 19.25 million pounds sterling will be spent on treatment systems, pumping plants, and sewers in Southwark and Beckton to accommodate the increasing population in the redeveloped Docklands. The capacity of the Fobney Water Works on River Kennet will be increased by 10 mgd to accommodate developments and industries in the Basingstoke-Reading area. The Reading treatment plant will be expanded from 11 to 14 mgd with a two-stage activated sludge operation using pure oxygen injection and surface aeration for nitrification. (Lisk-FIRL)
W78-09424

APPARATUS FOR SEPARATING FLOATING POLLUTANTS,
L. E. Dallamore.
U.S. Patent No. 4,067,811, 4 p, 4 fig, 11 ref; Official Gazette of the United States Patent Office, Vol. 966, No. 2, p 670, January 10, 1978.

Descriptors: *Patents, *Water pollution control, *Water quality control, Oil pollution, Oil spills, *Separation techniques, Equipment, Floating.

A sea-going apparatus is provided for separating floating pollutants from a body of water and particularly a vessel for use in clearing oil spills that is able to clear and recover large volumes of the oil from the sea. A vessel has an opening in at least one side to define an inlet for the pollutant and the top water layer. There are means within the vessel to impart a whirlpool motion to the admitted pollutant and water in which the pollutant forms a thickened upper layer. A nozzle is positioned at about the center to impart whirlpool motion. The nozzle projects upward. A separator is positioned beneath the nozzle so that floating pollutants can be removed from the top of the separator and water from the bottom of the separator. (Sinha-OEIS)
W78-09428

INFLUENCE OF TRICKLE AND SURFACE IRRIGATION ON RETURN FLOW QUALITY,
New Mexico State Univ., University Park. Dept. of Agronomy.
P. J. Wierenga.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-270 650, Price codes: A09 in paper copy, A01 in microfiche. Report EPA-600/2-77-093, May, 1977. 158 p, 29 fig, 48 tab, 12 ref, 1 append.

Descriptors: *Surface irrigation, Irrigation systems, *Irrigation practices, *Return flow, Cotton, Salts, Salinity, Soil investigations, Irrigation efficiency, Soil water, Soil moisture, *Trickle irrigation, *Water quality control.

A field study was conducted to determine the effects of controlled surface irrigation and trickle irrigation on the quality and quantity of irrigation return flow. Trickle irrigation resulted in cotton yields (3-year averages) which were 8.2 percent higher than those from the surface-irrigated plots, and with trickle irrigation 24 percent less water was used than with surface irrigation. Data on soil salt accumulation in the surface-irrigated plots showed an increase in salt concentration with depth to the caly-sand interface. Below the clay-sand interface at 80-100 cm, a sharp decrease in salt concentration was observed. It appeared that a larger change in soil salinity was produced by altering irrigation frequency than by chanding irrigation efficiency. Irrigating when 50 percent of the soil water had been depleted was the irrigation frequency most conducive to salt retention by the soils. It appeared that trickle irrigation was quite effective in controlling the volume of return flow, while maintaining relatively low salinity levels in the soil around the trickle emitters. Accumulated salts were readily moved away from trickle lines by heavy preplant irrigations or intense rains. (Skogerboe-Colorado State)
W78-09443

ASSESSMENT OF IRRIGATION RETURN FLOW MODELS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 5B.
W78-09445

NITRATE IN EFFLUENTS FROM IRRIGATED LANDS (ANNUAL REPORT),
California Univ., Berkeley.
For primary bibliographic entry see Field 5B.
W78-09447

CONTROL OF SEDIMENTS, NUTRIENTS, AND ADSORBED BIOCIDES IN SURFACE IRRIGATION RETURN FLOWS,
Agricultural Research Service, Kimberly, ID. Snake River Conservation Research Center.
D. L. Carter, and J. A. Bondurant.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-263 610, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/2-76-237, October 1976. 45 p, 2 fig, 7 tab, 49 ref.

Descriptors: Sediments, *Sedimentation, Nutrients, *Return flow, *Surface irrigation, *Sediment control, Erosion control, Runoff, Surface runoff, Technology, Irrigation, Soil conservation, Pesticides, Management.

The technology available for the control of sediments, nutrients, and adsorbed biocides in surface irrigation return flows has been reviewed and evaluated. Some of this technology could be applied immediately to reduce sediment and associated nutrient and biocide concentrations in surface irrigation return flows. Much of the available information needs to be integrated to develop improved control practices. New ideas and new control technology are needed. Economic incentive programs are needed to improve acceptance of control technology. The factors controlling erosion and subsequent sediment concentrations in surface irrigation return flows, and how these factors can be managed to reduce erosion and sediment concentrations are reviewed and discussed. (Skogerboe-Colorado State)
W78-09450

AN EVALUATION OF PROGRESSIVE TRENCHING AS A TECHNIQUE FOR DEWATERING FINE-GRAINED DREDGED MATERIAL,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5E.
W78-09476

EFFECT OF ENVIRONMENTAL REGULATIONS ON WATER MANAGEMENT IN (CZECHOSLOVAKIAN) PULP AND PAPER MILLS (VLIV VODOPRAVNICH PREDIPISU NA VODNI HOSPODARSTVI PAPIREN A LEPENKAREN),
F. Nemec.
Papir a Celuloza, Vol. 32, No. 7/8, p 193-194, 198, 1977. 3 tab.

Descriptors: *Water pollution control, *Pulp and paper industry, *Legislation, Europe, Foreign countries, Biochemical oxygen demand, Chemical oxygen demand, Dissolved oxygen, Water management(Applied), Water pollution sources, Pulp wastes, Czechoslovakia, Sulfite pulp mills.

Czechoslovakian laws No. 138/73, 130/74, 25/75, and 49/75 covering water management and water pollution control are discussed. Pollution discharge limits for point sources are based on receiving water quality. The man pollution characteristics include the BOD, COD, and dissolved oxygen (D.O.) level. For example, depending on the type of stream, the maximum 5-day BOD of the water should range from 4 to 8 mg/liter, COD (permanganate) from 8 to 20 mg/liter, and minimum D.O. from 50 to 70% of saturation. The approach to water pollution abatement taken by the centrally controlled Czechoslovakian pulp and paper industry consists of a gradual shutdown of small sulfite mills and concentration of pulp production in large mills located on big rivers. (Trubacek-IPC)
W78-09511

EXPERIENCE IN THE STUDY OF DENTAL CARIES AMONG THE POPULATION AND FLUORIDE CONTENT IN DRINKING WATER (IN RUSSIAN),
For primary bibliographic entry see Field 5F.
W78-09513

INTEGRATED RESIDUALS MANAGEMENT: A REGIONAL ENVIRONMENTAL QUALITY MANAGEMENT MODEL,
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 6A.
W78-09516

ENVIRONMENTAL ASSESSMENT--MANAGEMENT SYSTEM FOR LOCAL DEVELOPMENTAL PROJECT: CASES IN JAPAN,
Nagoya Univ. (Japan). Inst. of Earth Sciences.
For primary bibliographic entry see Field 6A.
W78-09517

DEVELOPMENT OF A MATHEMATICAL WATER QUALITY MODEL FOR GRAYS HARBOR AND THE CHEHALIS RIVER, WASHINGTON.
Battelle Pacific Northwest Lab., Richland, WA.
For primary bibliographic entry see Field 5B.
W78-09518

SYSTEMS PROGRAM FOR THE ANALYSIS OF NONURBAN, NONPOINT SOURCE POLLUTANTS IN THE MISSOURI BASIN REGION,
Midwest Research Inst., Kansas City, MO.
For primary bibliographic entry see Field 5B.
W78-09519

SYSTEMS PROGRAMS FOR THE ANALYSIS OF NONURBAN, NONPOINT SOURCE POLLUTANTS IN THE MISSOURI BASIN REGION. SUPPLEMENT,
Midwest Research Inst., Kansas City, MO.
For primary bibliographic entry see Field 5B.
W78-09520

NATURAL REFORESTATION RECLAIMS A WATERSHED: A CASE HISTORY FROM WEST VIRGINIA,
Sao Paulo Univ. (Brazil). Dept. de Silvicultura.
For primary bibliographic entry see Field 4D.
W78-09525

ESTIMATES OF POPULATION SIZE AND SURVIVAL OF IMMATURE STAGES OF FOUR SPECIES OF AEDES (DIPTERA: CULICIDAE) IN A TEMPORARY POND,
Calgary Univ. (Alberta). Dept. of Biology.
M. A. Enfield, and G. Pritchard.
The Canadian Entomologist, Vol. 109, p 1425-1434, November 1977. 2 fig, 7 tab, 8 ref.

Descriptors: *Mosquitoes, *Aedes euedes, *Ponds, *Larvae, *Eggs, *Temporary pond stage, Aedes vexans, Aedes cinereus, Aedes mercurator, Canada, Alberta(Canada), Survival, Population, Culicidae, Pupae, Water level fluctuations, Predation.

A temporary pond near Calgary, Alberta, Canada was sampled in 1974 and 1975 for mosquito eggs, larvae, and pupae of the genus Aedes, and population and survival estimates were made of A. Vexans, A. Cinereus, A. Euedes, and A. Mercurator. Results were studied in relation to the history of the pond for the two years. During spring of the first year the pond filled to a much higher level than normal and did not dry and reflood until August. In the second year the pond contained water from mid-April to the beginning of June, and did not refill during summer. The first flooding in 1974 hatched eggs of A. euedes, A. cataphylla, A. excrucians, A. fitchii, A. flavescens, and A. mercurator; the second flooding hatched eggs of A. vexans and A. cinereus. Population estimates were made for the latter two species. Little larval mortality occurred until the pond was reduced to a few puddles and larvae were stranded. Of surviving A. vexans larvae, 50% attained instar II in 3.7 days, instar III in 6.6 days, and instar IV in 10.3 days. A. cinereus developed more slowly. In 1975 population estimates were made for larvae of A. euedes and A. mercurator, which preferred deeper water. A. euedes declined at nine per day and A. mercurator at seven per day. Larvae in the second instar survived for three days when the surface was covered with ice and snow, but A. euedes experienced a sharp drop in numbers at that time. Fifty-three percent of A. vexans eggs survived for one year in areas not flooded at appropriate temperatures for hatching. (Lynch-Wisconsin)
W78-09549

REPORT OF THE DANE COUNTY ADVISORY COUNCIL FOR LAKE QUALITY IMPROVEMENT, A FRAMEWORK FOR LAKE MANAGEMENT.
Wisconsin Lake Quality Improvement Advisory Council, Madison.
For primary bibliographic entry see Field 5C.
W78-09552

COOLING TOWER ENVIRONMENT--1978 (WITH SUPPLEMENT).
Maryland Univ., College Park. Water Resources Research Center.
For primary bibliographic entry see Field 5A.
W78-09570

A STUDY OF ESCHERICHIA COLI SURVIVAL IN HIGH LATITUDE WATERS (IN RUSSIAN),
Murmanskii Morskoi Biologicheskii Inst. (USSR).
For primary bibliographic entry see Field 5B.
W78-09577

HYGIENIC PROBLEMS OF ENVIRONMENTAL PROTECTION FROM THE WASTES OF LIVESTOCK COMPLEXES AND POULTRY FARMS (IN RUSSIAN),
D. P. Nikitin, and Yu. V. Novikov.
Gig Sanit (4), p 61-67, 1977.

Descriptors: Bacteria, Chemicals, Eggs, Helminth, Pollutants, USSR, Livestock, *Farm wastes, Public health, *Waste treatment, Water pollution.

Livestock complexes poultry farms are a potential source of soil, water and air pollution with noxious chemicals pathogenic bacteria and helminth eggs. Data from various studies on these problems in the USSR are reviewed, along with proposals for different systems for the purification of the animal wastes as organic fertilizer, the development of effective measures for their purification and utilization is important.--Copyright 1978, Biological Abstracts, Inc.
W78-09581

HYGIENIC ASSESSMENT OF THE EFFECTIVENESS OF MEASURES USED FOR PREVENTING CONTAMINATION OF THE TOMI RIVER (IN RUSSIAN),
Nauchno-Issledovatelskii Inst. Gigieny, Moscow (USSR).
V. A. Savelova, V. P. Kovtun, and I. I. Belozertsev.
Gig Sanit 8, p 19-22. 1977.

Descriptors: Russian-SFSR, *USSR(Tomi River), *Water pollution control, Water pollution sources.

Actual data on sanitary-laboratory control of the Tomi River (Russian SFSR, USSR) water contamination in the present consumption rate of its water and the mathematically estimated concentrations of contamination, prevailing from 1970-1975, made it possible to detect definite positive shifts in the sanitary state of the river due to measures taken for its protection. In the use of the calculation method more definite results were obtained that corresponded to the time of taking measures for improvement of sanitary conditions.--Copyright 1978, Biological Abstracts, Inc.
W78-09582

UPGRADING STABILIZATION POND EFFLUENT BY WATER HYACINTH CULTURE,
Texas Dept. of Health, Austin.
For primary bibliographic entry see Field 5D.
W78-09594

AN INTRODUCTION TO FOUR OVERVIEWS: ARID AND SEMI-ARID LANDS; SOIL LOSS; TROPICAL FORESTS AND WOODLANDS; WATER QUALITY,
United Nations Environment Program, New York.
For primary bibliographic entry see Field 6G.
W78-09657

SOIL CONSERVATION ON AGRICULTURAL LAND: THE CHALLENGE AHEAD,
Soil Conservation Service, Washington, DC.
For primary bibliographic entry see Field 3F.
W78-09659

NO SIMPLE ANSWERS ON SALINITY,
E. McNeill.
Irrigation Journal, Vol 26, No 6, p 16-18, November-December, 1977. 5 fig.

Descriptors: *Salinity, *Saline water, *Saline soils, Water quality, *Water quality control, Salts.

Salinity control is the most critical problem facing agricultural irrigation managers in the arid Western states, according to opinions of water specialists before a late September conference Salt and Salinity Management in Santa Barbara, California. To search for solutions on how to manage agricultural lands served by irrigation waters containing an increasing build-up of salts, some 150 professionals in the management, government and educational fields met at the two-day conference to hear and study the findings of an extensive group of authoritative speakers who have actively worked on the problem. (Skogerboe-Colorado State)
W78-09666

THE WELLTON-MOHAWK: WHERE NECESSITY IS TEACHING THEM TO SAVE WATER,
For primary bibliographic entry see Field 3B.
W78-09668

SAXON V. DIVISION OF STATE LANDS (DENIAL OF PERMIT APPLICATION TO FILL SALTMARSH).
For primary bibliographic entry see Field 6E.

W78-09685

PACIFIC LEGAL FOUNDATION V. QUARLES (POWER OF ENVIRONMENTAL PROTECTION AGENCY TO FORMULATE CONDITIONS FOR NATIONAL POLLUTANT DISCHARGE SYSTEM PERMIT).
For primary bibliographic entry see Field 6E.
W78-09694

SOLE OR PRINCIPAL SOURCE AQUIFER AREAS.
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
Federal Register, Vol. 42, No. 189, p 51620-51625 (September 29, 1977).

Descriptors: *Aquifers, *Water supply, *Project planning, Development, Government financing, *Water quality control, Groundwater, Water sources, Reservoirs, Management, Recharge, Aquifer management, Loans, Grants, Project purposes, Planning, Alternate planning, Administration, Benefits, Water policy, Competing uses, Projects, Project benefits, Aquatic environment.

The Environmental Protection Agency (EPA) proposed regulations to implement aquifer requirements of the Safe Drinking Water Act (SDWA). The regulations established procedures for designating areas where an aquifer is the sole or principal source of drinking water. The Administrator may determine upon his own motion or upon receipt of a public petition, that 'an area has an aquifer which is the sole or principal drinking water source for that area and which, if contaminated, would create a significant hazard to public health.' Upon such a determination, no commitment for federal financial assistance may be entered into for any project which the Administrator determines may contaminate the aquifer through a recharge zone and create a significant hazard to public health. However, programs will be subject to EPA's project review authority only if an application for federal financial assistance has been submitted. Since some actions may have been subject to the provisions of the National Environmental Policy Act (NEPA) and thereby the subject of an environmental impact statement, the subject of project review under the SDWA will be integrated as fully as possible with the NEPA to avoid needless duplication. (Kastner-Florida)
W78-09695

CARBON BLACK MANUFACTURING POINT SOURCE CATEGORY EFFLUENT GUIDELINES AND STANDARDS.
Environmental Protection Agency, Washington, DC.
Federal Register, Vol. 43, No. 5, p 1343-47, January 9, 1978.

Descriptors: *Water pollution sources, *Permits, *Water pollution control, *Federal Water Pollution Control Act, Adoption of practices, Regulation, Administrative agencies, Federal government, Discharge(Water), Liquid wastes, Pollution abatement, Carbon.

The 1976 interim regulations and proposals promulgated by the Environmental Protection Agency (EPA) effluent limitations guidelines for the Carbon Black Manufacturing Point Source Category are herein issued in final form. With the exception of effluent limitations guidelines based upon the use of the best practicable control technology currently available for the furnace process subcategory, which have been withdrawn, they are identical to the interim form. The effluent limitations guidelines based upon the use of the best available technology economically achievable for the carbon black furnace process is instead being promulgated to require zero discharge of process waste water. The guidelines and new source performance standards, when applicable, will be incorporated in National Pollutant Discharge Elimination System (NPDES) permits issued by the EPA or by states with approved programs. However, dischargers will not be allowed to initiate a discharge or to increase the quantities or concentration of pollutants discharged without appropriate issuance of NPDES permits. (Rule-Florida)
W78-09696

IMPLEMENTATION OF SECTION 208 IS FINALLY UNDERWAY: ENVIRONMENTAL LAW INSTITUTE WILL ASSIST BY PREPARING HANDBOOK FOR DESIGNATED AGENCIES.
Environmental Law Reporter, Vol. 6, No. 1, p 10039-10040 (January, 1976).

Descriptors: *Water pollution control, *Federal Water Pollution Control Act, *Water management(Applied), *Water resources planning, Regional development, Social aspects, Programs, Management, Legislation, Governments, Decision making, Project planning, Water law, Water policy, Water pollution treatment, Water pollution sources, Administrative agencies, State governments, Permits.

The differences in the sources of pollution problems and in the legal and political environments across the country make it impossible to recommend a single, most-desirable solution for each water pollution problem. The Environmental Protection Agency, recognizing this, awarded the Environmental Law Institute (ELI) an eight-month contract to prepare a handbook which would assist local governments in the design of regulatory programs for the control of water pollution. The handbook should focus on the legal and institutional aspects of those regulatory programs and is intended to supplement other technical studies. Section 208 of the Federal Water Pollution Control Act Amendments of 1972 is considered to be the most significant of several of the Act's planning requirements; however, implementation of Section 208 was slow in getting underway. The ELI handbook would facilitate implementation by including examples of a variety of documented control techniques for the most difficult water pollution problems. It would also explore the choice of appropriate governmental bodies to enact and administer controls, and analyze in depth representative state and local statutes which appear to be the most practical solutions to particular problems. (Stump-Florida)
W78-09698

SECTION 1424 (E) OF THE SAFE DRINKING WATER ACT: AN EFFECTIVE MEASURE AGAINST GROUNDWATER POLLUTION,
J. B. Hemphill.
Environmental Law Reporter, Vol. 6, p 50121-50126 (January-December, 1976).

Descriptors: *Legislation, *Texas, *Water sources, *Water supply, *Aquifer management, Legal aspects, Municipal water, Administrative decisions, Governmental interrelations, Water law, Water utilization, Impaired water quality, Water pollution control, Water pollution sources, Water quality control, Aquifers, Reservoir storage, Water storage, Water pollution.

Much of the drinking water in use today has its source in underground reservoirs known as aquifers. Groundwater aquifers in 1974 received partial regulatory protection under Section 1424 (e) of the Safe Drinking Water Act. Section 1424 (e) prevents the federal government from sponsoring or encouraging activities which might result in contamination of groundwater drinking supplies. It also provides for the Administrator of the Environmental Protection Agency (EPA) to determine if an aquifer is in need of protection from contamination if the aquifer is the principal drinking water source for the area. Section 1424 (e) has been applied by the EPA in the single instance of the Edward's Aquifer near San Antonio, Texas. Because San Antonio receives its entire water supply from the Edward's Aquifer, the EPA took the position that since the sole source aquifer was vulnerable to contamination, there was a presumption that such contamination would create a significant health hazard. Because Section 1424 (e) reaches only sole or principal source aquifers threatened by contamination from federally funded projects, additional protection from groundwater contamination by non-federally sponsored activity must come from future legislation. (Curtis-Florida)
W78-09699

WATER POLLUTION CONTROL: AN OVERVIEW OF THE LAWS,
Environmental Protection Agency, Washington, DC. Water Planning and Standards.
E. C. Beck.
Park and Recreation, Vol. 12, No. 2, p 5a-14a (February, 1977).

Descriptors: *Water pollution control, *Pollution abatement, *Federal Water Pollution Control Act, *Planning, Agricultural runoff, Acid mine water, Local governments, Public health, Water law, Water quality control, Drainage water, Facilities, Recreation, Construction, Permits, Streams, Rivers, Lakes.

Although water pollution has been recognized as a problem since 1900, it was not until the 1970's that the scope and priority of water pollution control changed. First, the Federal Environmental Protection Agency was created, centralizing responsibility for water pollution control. Second, the Federal Water Pollution Control Act Amendments of 1972 were passed. Concern about non-point pollution sources also emerged at this time. The 1972 Act contains provisions that encourage public participation in pollution control. In addition, it calls for an annual assessment of statewide water quality problems and authorizes federal resources to solve the problems. The water quality management section of the Act, the most comprehensive part of the Act, provides information for sound decision making by state and local officials and is the only authority under federal law to control non-point source pollution. Section 303 of the Act establishes water quality goals and standards for water quality improvement; section 402 implements a rational permit program to control the discharge of pollutants into waterways from point sources. It also contains enforcement provisions. Section 404 authorizes the Corps of Engineers to issue permits for discharging dredged or fill material. (Maass-Florida)
W78-09707

A RESEARCH STRATEGY FOR SOCIAL ASSESSMENT OF LAKE RESTORATION PROGRAMS,
Oregon State Univ., Corvallis. Dept. of Anthropology.
W. D. Honey, and T. C. Hogg.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-278 347, Price codes: A04 in paper copy, A01 in microfiche. Report EPA-600/5-78-004, February 1978. 2 fig, 26 ref, 3 append. 1BA608, CC6991885-A.

Descriptors: *Lake restoration, *Social impact, *Methodology, *Water pollution control, *Clean Lakes Program, Lakes, Rehabilitation, Model studies, Social aspects, Ecology, Analytical techniques.

A methodology is provided for assessing the social impact of lake restoration programs, as part of the Clean Lakes Program established by the Federal Water Pollution Control Act Amendments of 1972. The methodology is based on a cultural ecological model, derived from work by Julian Steward (1955). The model relates human adaptation to cul-

tural development in evolutionary terms, and seeks to explain the origin of particular cultural features and patterns in an area. The 'cultural core,' or central environmental feature, is important to the model; its determination is largely dependent on empirical data. The model requires both spatial and temporal parameters: spatial parameters include primary and secondary zones of influence; temporal phases include planning, lake treatment, and restored lake conditions. Application of Steward's framework includes: (1) a historical emphasis which identifies and explains the central environmental feature and its interrelationship with cultural patterns; and (2) environmental-cultural system interplay which determines to what extent the environment will permit technological innovations and identifies special features of the cultural system on which human adaptation depends. All data are examined in terms of five instrumental cultural functions: (1) physical well-being of the population, (2) enhancement of livelihood, (3) community, (4) communication, and (5) innovation. The plan has not yet been field tested. (Lynch-Wisconsin)
W78-09710

FEDERAL LAW, IRRIGATION AND WATER POLLUTION,
T. Hertz.
South Dakota Law Review, Vol. 22, No. 3, p 553-590 (Summer, 1977).

Descriptors: *Dissolved solids, *Federal Water Pollution Control Act, *Irrigation effects, *Water pollution control, Administrative agencies, Agriculture, Federal government, Irrigable land, Irrigation, Irrigation practices, Irrigation water, Legal aspects, Water law, Water pollution, Water policy, History, Hydrologic cycle, Salinity, Soil water, Economics.

The Federal Water Pollution Control Act of 1972 (FWPCA) was written primarily for the kind of pollution that comes out of a factory pipe and runs into a stream. The Environmental Protection Agency (EPA) approaches irrigation-caused water pollution in the same way it approaches industrial pollution. The tool used for both is the FWPCA National Pollution Discharge Elimination System (NPDES) permitting program which controls effluent discharges from point sources. However, irrigation water does not reenter streams and rivers from a point source. The key to achieving a permanent irrigated agriculture system is to achieve water and salt balance. The amount of water and salt added by irrigation practices must not exceed that removed by consumptive use and by irrigation return flow. The FWPCA divides water pollution problems into two areas: point sources and nonpoint sources. Nonpoint source discharges, such as those that result from natural events such as precipitation runoff over large areas of land, are excluded from the NPDES permit program. The author notes that the problems of pollution do not go away by definition and that the EPA is charged with enforcing reduction and elimination of water pollution regardless of the source of that pollution. (Jordan-Florida)
W78-09724

TOWARD CLEAN WATER: A GUIDE TO CITIZEN ACTION.
Conservation Foundation, Washington, DC.
August, 1976, 316 p.

Descriptors: *Federal Water Pollution Control Act, *Water quality control, *Water management(Applied), *Water pollution treatment, Public benefits, Legislation, Water quality standards, Water policy, Law enforcement, Permits, Administrative agencies, Regulation.

In 1972, sweeping new amendments were added to the Federal Water Pollution Control Act (FWPCA). Minimum guidelines for public participation in the development and enforcement of programs established by the Environmental Protection Agency or state agencies were mandated. These guidelines included: timetables for the publication of program regulations and acceptance of public comments+ ground rules for the conduct of public hearings and meetings; and descriptions of the required makeup of advisory boards and other citizens' bodies. The agencies were also mandated to keep technical data accessible and to encourage citizens to report pollution regulations violations. The broad purpose of this book is to provide interested laypersons with the informational background and statutory understanding necessary for their use of the 1972 FWPCA Amendments. It is expected that the book will be useful to citizens, public officials, engineers, industry representatives and person interested in either enforcing, developing or complying with the FWPCA mandates. Several chapters and an appendix of specific regulations provide information on state and local assistance program grants, the National Pollutant Discharge Elimination System, dredge, spoil and fill regulations, and ocean-dumping permits. An extensive bibliography is included. (Baumbach-Florida)
W78-09727

CONTROL OF OIL TRANSPORT IN THE COASTAL ZONE: A LOOK AT PUGET SOUND,
Environmental Protection Agency, Seattle, WA. Region X.
R. A. Du Bey.
Oregon Law Rev., Vol. 56, No. 4, p 593-645 (1977).

Descriptors: *Coasts, *Water quality control, *Transportation, *Oil industry, *Federal-state water rights conflicts, Federal jurisdiction, State jurisdiction, Federal Water Pollution Control Act, Oil spills, Public benefits, Oil fields, Water law, Environment, Management, Governmental interrelations, Energy, Legal aspects, Judicial decisions, Legal review.

Since 1973, the transportation of Alaskan oil to the continental United States has become an issue of utmost national importance. Any attempt by a coastal state to influence the development and transportation of Alaskan crude oil, presumably based on the constitutional exercise of the state's police powers aimed at protecting the quality of its coastal waters, would raise a number of legal issues. The issues include: (1) what is the current jurisdictional framework of federal and state relations regarding the transportation of crude oil in the coastal zone; (2) what are the federal constraints upon the exercise of state power; (3) what bases exist for state control of the marine transport of oil; and (4) what effect will the national Coastal Zone Management Act of 1972 have on the balance between state and federal power in the coastal zone. Examined in this context are the Federal Water Pollution Control Act Amendments of 1972 and the Trans-Alaska Pipeline Authorization Act. The author concludes that the issue of defining the relative roles that state and federal governments should play in controlling oil transportation in the coastal zone has yet to be determined by the courts. (Easterbrook-Florida)
W78-09732

THE EVOLUTION AND IMPLEMENTATION OF EPA'S REGULATORY PROGRAM TO CONTROL THE DISCHARGE OF TOXIC POLLUTANTS TO THE NATION'S WATERS,
Environmental Protection Agency, Washington, DC.
R. M. Hall, Jr.
Natural Resources Lawyer, Vol. 10, No. 3, p 507-529 (1977).

Descriptors: *Federal Water Pollution Control Act, *Water quality, *Water pollution control, *Toxins, *Administration, Discharge(Water), Pollutants, Pollution abatement, Industrial wastes, Water policy, Legislation, Legal aspects, Water treatment, Industries, Priorities, Pretreatment(Water), Water pollution, Regulation, Legal review, Administrative agencies.

In June of 1976, a consent decree was issued by the United States District Court for the District of Columbia approving a comprehensive strategy for the regulation of the discharge of toxic pollutants under the Federal Water Pollution Control Act (FWPCA). The author discusses the background of the decree and evaluates the progress that the Environmental Protection Agency (EPA) has made towards implementing toxic pollutant control. The statutory framework of the FWPCA is explored, and the EPA's initial efforts to control toxic pollutants is reviewed. The evolution of the integrated toxic strategy resulted in an industry approach implementing effluent limitations and pretreatment standards. The program following the consent decree has resulted in major steps forward in the implementation of the FWPCA, First, standards were finally promulgated under Section 307 (a). Second, the scope of regulation of toxic pollutants has broadened and become more effective since the EPA has begun to implement numerous sections of the FWPCA. Finally, the emphasis on regulation of toxic pollutants reflects the priorities stressed by Congress and President Carter. (Quarles-Florida)
W78-09733

MINERAL RIGHTS-CONVEYANCES AND LEASES IN MISSOURI,
P. N. Davis.
Missouri Bar Journal, Vol. 33, No. 4, June, 1977, p 248-56.

Descriptors: Mineralogy, *Mining, *Leases, *Missouri, *Mine drainage, Riparian rights, Groundwater, Surface waters, Water quality, *Acid mine water, Diversion, Surface runoff.

Mining can interfere with supplies in five ways. Among these methods of interference are draining and blasting. Missouri follows the law of riparian rights to govern water diversions. This law applies to the mineral transferee in his relationship with other riparians and with the transferor. The transferee would probably be treated as any nonriparian grantee by the courts. Three rules govern the alteration of percolating groundwater supplies by well diversion or drainage: the absolute ownership rule; the 'reasonable use' rule; and the 'correlative rights' rule. Missouri has adopted this third rule the mineral transferee, like any landowner, is subject to these rules. Diffused surface water is also controlled by three rules: the common enemy rule; the civil law rule; and the reasonable use rule. The common enemy rule applied in Missouri, and the transferee must adhere to it. Although water diversion laws were written in terms of adjoining landowners, they apply to mineral transferor and transferee. Mineral leases should specify terms regulating when blasting may occur and acceptable blasting damages. Ten common mining methods exist. The transferee may be required to compensate the surface owner for any crop destruction. (Spiegel-Florida)
W78-09734

ANNOTATED BIBLIOGRAHY FOR WATER QUALITY MANAGEMENT, (FOURTH EDITION).
Environmental Protection Agency, Washington, DC. Water Planning Div.
May 1977, 59 p.

Descriptors: *Bibliographies, *Water quaity, Water quality control, Waste management, Agriculture, Hydrology, Groundwater, Water Pollution, Pollution, Model studies, *Management.

This bibliography has been prepared to assist those who are engaged in 208 water quality management. References cited have been selected for their applicability to water quality management and for their availability. Each of the 226

references is followed by a short abstract and, whenever possible, by price and ordering information. Instructions for using the Government Printing Office, the National Technical Information Service, and for ordering books through the EPA Regional offices or the EPA Water Quality Management Information Center in Washington, D.C. are included. (Skogerboe-Colorado State)
W78-09760

SOIL AND WATER CONSERVATION PRACTICES FOR POLLUTION CONTROL,
Cornell Univ., Ithaca, NY. Dept. of Agricultural Engineering.
M. F. Walter, T. S. Steenhuis, and D. A. Haith.
Paper No. 77-2506 presented at the 1977 Winter Meeting of the American Society of Agricultural Engineers, December 13-16, 1977, Chicago, Illinois, 19 p, 6 tab, 42 ref.

Descriptors: *Soil conservation, *Water conservation, Water quality, *Water quality control, Pollutants, *Water pollution control.

Policy concerning best management practices (BMP) to control agricultural nonpoint source pollution has yet to be developed. There has been a tendency to equate BMP's with soil and water conservation practices. SWCP's are relatively well understood, are apparently productive, and have a delivery system. SWCP's must be capable of enhancing water quality if they are to be used as BMP's. The effect of SWCP's on water quality is discussed. (Skogerboe-Colorado State)
W78-09768

SOIL-SALT INTERACTIONS IN RELATION TO SALT CONTROL,
California Univ., Davis. Dept. of Land, Air and Water Resources.
J. W. Biggar, and K. K. Tanji.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol 20SW, p 68-75, February 20, 1077. 1 tab, 50 ref, 9 equ.

Descriptors: Root zones, *Return flow, *Salts, Cation exchange, Ion exchange, Water management(Applied), Crop production, *Salt tolerance, Soils, *Forecasting.

An appraisal is made on the difficulties of predicting and evaluating mass emission of salts in irrigation return flows. The more important physicochemical processes that occur in the root zone are identified and the complexity and state-of-the-art knowledge of them is discussed. (Skogerboe-Colorado State)
W78-09771

RECLAIMING PARTIALLY CLOGGED TICKLE EMITTERS,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
F. S. Nakayama, D. A. Bucks, and O. F. French.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 20SW, p 278-280, April 20, 1977. 1 fig, 1 tab, 9 ref.

Descriptors: *Irrigation systems, *Trickle filters, *Clogging, Flow rate, Laboratory tests, Injection.

A trickle emitter system, which had become partially clogged after 2 years of operation even with extensive water filtration, was reclaimed successfully by treating the entire system with concentrated hypochlorite and acid solutions. Chemical cost per emitter was less than replacement cost for the emitter and supply tubing. Maintenance treatment with low levels of hypochlorite and acid prevented recurrence of emitter plugging. (Skogerboe-Colorado State)
W78-09774

CALLAHAN RESERVOIR: II. INFLOW AND OUTFLOW SUSPENDED SEDIMENT PHOSPHORUS RELATIONSHIPS,
Agricultural Research Service, Oxford, MS. Sedimentation Lab.
J. D. Schreiber, D. L. Rausch, and L. L. McDowell.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 20SW, p 285-289, April 20, 1977. 5 fig, 4 tab, 23 ref.

Descriptors: *Missouri, Sediments, Flood control, Reservoirs, Downstream, Agricultural watersheds, *Phosphorus, *Callahan Reservoir(MO), *Suspended solids.

The inflow and outflow of Callahan Reservoir, located in an agricultural area near Columbia, Missouri, was studied for 1 year to understand the sediment and solution phosphorus (P) relationships. The solution phase was analyzed for dissolved organic, hydrolyzable, and ortho-P and the sediment was analyzed for total, inorganic, and organic P. The discharge weighted mean solution phase concentration of dissolved organic, hydrolyzable, and ortho-P for the inflow was 0.008, 0.002 and 0.059 mg/l, respectively, as compared with 0.011, 0.005, and 0.021 mg/l for the outflow. The outflow sediment had a larger concentration (millimicro-g/g) of total, inorganic, and organic P than did the inflow sediment. However, because of sediment deposition within the reservoir, there was a 4-fold decrease in outflow suspended sediment P volume concentrations (mg/l). Isotopic dilution techniques with 32P were used to estimate the portion of sediment-P31 in equilibrium with solution-P31. The quantities of isotopically exchangeable sediment-P31 in the inflow and outflow sediments were 30 and 41 millimicro-g/g, respectively. (See also W77-12149) (Skogerboe-Colorado State)
W78-09775

SOIL-ASPHALT MIXTURE FOR CANAL SEEPAGE CONTROL: LABORATORY STUDY,
Department of Agriculture, Lethbridge (Alberta). Research Station.
For primary bibliographic entry see Field 4A.
W78-09787

NEW FACILITY HELPS CLEAN UP BOSTON HARBOR.
For primary bibliographic entry see Field 5D.
W78-09791

COLORADO RIVER DESALINIZATION, WILD DUCK STUDY,
Colorado State Univ., Fort Collins, Dept. of Physiology and Biophysics.
D. H. Will, J. H. Abel, B. E. Russell, and K. E. Levine.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 681, Price codes: A03 in paper copy, A01 in microfiche. Final Project Report to Bureau of Reclamation, Denver, Colorado, U.S. Department of the Interior, June 1977, 21 p. 6 ref, 1 tab.

Descriptors: *Colorado River, Colorado basin, *Salinity, *Ducks(Wild), Mallard duck, Laboratory tests, Animal physiology, Animal pathology, *Animal behavior, Mortality, Bioassay, *Saline lakes, Saline water, Paradox Valley, Dolores River, Dehydration, Hypothermia.

The Paradox Valley drainage of the Dolores River in southwestern Colorado, is an important natural contributor of salts to the Colorado River. One proposed means of reducing salinity in the Colorado River is the diversion of the Paradox Valley drainage into large solar evaporation reservoirs where the salts could be retained. The present study was performed to determine the possible detrimental effects of concentrated salt water, simulated approximately 70 percent evaporation of the Paradox Valley drainage on a single waterfowl species, the wild mallard duck. Seven separate experiments were conducted using a total of 94 mallard ducks (47 males, 47 females). The study clearly demonstrated that highly concentrated salt or brine water can be lethal to wild waterfowl such as the mallard duck. Mortality in the ducks exposed to the salt water appeared to relate principally to dehydration and hypothermia. It was evident that when placed in the highly concentrated salt water the ducks soon showed discomfort and when given a choice preferred to leave the saline pool. This behavior suggests that in the wild, ducks landing on a brine pool would be probably soon choose to leave for surrounding lead or a fresh water source, particularly if one is close by.
W78-09799

EFFECTS OF PHOSPHATE MINERALIZATION AND THE PHOSPHATE INDUSTRY ON RADIUM-226 IN GROUND WATER OF CENTRAL FLORIDA,
Office of Radiation Programs, Las Vegas, NV.
R. F. Kaufman, and J. D. Bliss.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-274 116, Price codes: A07 in paper copy, A01 in microfiche. Report EPA 520-6-77-010, Oct. 1977, 115 p, 7 tab, 18 fig, 65 ref.

Descriptors: *Florida, Hydrology, Water pollution, Water quality, Public health, Groundwater, *Groundwater basins, Ground water resources, Hydrogeology, Phosphates, *Radium radioisotopes, On-site-investigations, Statistical methods, *Mining, Florida hydrology survey, *Phosphate mining, Radiation surveys, Environmental surveys.

Dissolved radium-226 data were statistically analyzed to characterize water quality in the water table, Upper Floridan and Lower Floridan aquifers in six counties of west central Florida where major strip mining and beneficiation of phosphate deposits is underway. Mineralization and mining have not significantly increased the dissolved radium content of native ground water, although locally elevated levels of radium in both mineralized and nonmineralized areas are naturally present. In Hillsborough, Polk, Hardee, and De Soto Counties, mean radium content of ground water beneath mined and unmined lands is 5 pCi/l or less, with maximum values on the order of 15 to 20 pCi/l occurring in unmined areas. For Sarasota and Manatee Counties, average radium content is 4 to 15 pCi/l in the water table and Floridan aquifers. Although portions of these latter two areas are mineralized, there has been no mining activity to date. (EIS-Katz)
W78-09800

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

INTEGRATED RESIDUALS MANAGEMENT: A REGIONAL ENVIRONMENTAL QUALITY MANAGEMENT MODEL,
Resources for the Future, Inc., Washington, DC.
W. O. Spofford, Jr.
Reprint 130, Resources for the Future, Washington, D.C., 1976 (originally titled 'Total Environmental Quality Management Models,' reprinted from 'Models for Environmental Pollution Control,' R.A. Deininger (Ed), 36 p, 2 fig, 1 tab, 54 ref. $0.25.

Descriptors: *Environment, *Water quality, *Management, *Model studies, *Quality control, Wastes, Air pollution, Waste disposal, Regions, Systems analysis, *Simulation analysis, Optimization, Equations, *Residuals management, Environmental quality, Nonlinear programming.

The effort to integrate models of air and water pollution and solid waste disposal into an overall environmental quality model is described. The term 'total environmental quality management models' is defined as meaning 'regional residuals-environmental quality management models,' where these include only the impacts on environmental quality of residuals discharges to the air, water, and land environments. The term 'residual' is preferred here to that of 'waste'. The entire regional residuals management system is delineated, including the range of management options available to society for improving environmental quality; indicated is how all the system components may be expressed and ultimately linked together within the same computational framework. The residuals management model is discussed qualitatively and then formulated quantitatively; mathematical forms of the various environmental models are discussed, and computational schemes for selecting an optimal management strategy are suggested. Included are: residuals generation and discharge models; environmental modification and environmental quality models; a management model formulation and a procedure for optimizing a nonlinear objective function subject to a set of linear constraints; an atmospheric dispersion model; an aquatic ecosystem model; and more optimization procedures, including a heuristic approach. The regional residuals management model suggested herein is more complex than the classical management model approach, and it requires a substantial amount of computer resources. (Graf-Cornell)
W78-09516

ENVIRONMENTAL ASSESSMENT--MANAGEMENT SYSTEM FOR LOCAL DEVELOPMENTAL PROJECT: CASES IN JAPAN,
Nagoya Univ. (Japan). Inst. of Earth Sciences.
Y. Shimazu, and R. Harashima.
Journal of Environmental Management, Vol. 5, No. 3, p 243-258, July 1977. 4 fig, 4 tab.

Descriptors: *Environmental effects, *Assessment, *Inland projects, *Regional development, Management, Water resources, Monitoring, Decision making, Land use, Economics, Social aspects, *Japan.

Developmental projects in Japan are classified into two types: (1) coast types at a national-regional level; and (2) inland types at a regional-local level. Thoughtless deforestation and engineering works are major causes of environmental disruption in inland-type developmental projects, destroying the nature and culture of less-developed villages. A comprehensive environmental assessment system for a local, inland-type project has been developed and applied to several situations with success. This system consists of the following: (1) main subsystems which cover legislative procedure, document retrieval, grid analysis, wildlife surveys, vegetation, microbiological diversity, landslide monitoring, watersheds, flood monitoring, water quality irrigation and drainage, traffic monitoring, landscaping, community affairs, social response, conflict resolution land use, finance, cost/benefit analysis, and an information channel; (2) a monitoring system to check progress and provide early warnings to prevent disasters; and (3) a coordinating system to provide a link between the inhabitants and the developer. For (2) and (3), an environmental management center is established. The total system is interdisciplinary, but it does not require a large project team. (Bell-Cornell)
W78-09517

SYSTEMS PROGRAM FOR THE ANALYSIS OF NONURBAN, NONPOINT SOURCE POLLUTANTS IN THE MISSOURI BASIN REGION,
Midwest Research Inst., Kansas City, MO.
For primary bibliographic entry see Field 5B.
W78-09519

SYSTEMS PROGRAMS FOR THE ANALYSIS OF NONURBAN, NONPOINT SOURCE POLLUTANTS IN THE MISSOURI BASIN REGION. SUPPLEMENT,
Midwest Research Inst., Kansas City, MO.
For primary bibliographic entry see Field 5B.
W78-09520

PLAYER'S GUIDE. THE RIVER BASIN MODEL.
Washington Environmental Research Center, DC. Environmental Studies Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-258 276, Price codes: A14 in paper copy, A01 in microfiche. Prepared for Environmental Protection Agency, Office of Research and Monitoring, Environmental Studies Division, Washington, D.C., 1973. 290 p, 4 fig, append.

Descriptors: *River basin development, *Regions, *Planning, *Simulation analysis, *Human interaction, Decision making, Governments, Mathematical models, Agriculture, Income, Farms, Employment, Parks, Land use, Zoning, Computer programs, Federal budget, Maps, Economic development, Demography, Statistical data, Systems analysis.

The River Basin Model places an emphasis on 'River' as it leads one to believe that the model is primarily concerned with water management. The stress should be placed on 'River Basin', and that term should be interpreted in its broadest sense as meaning a geographic area of land. Through its two major components--human interaction and computer simulation--the model represents the economic, social and governmental activity that takes place within the geographical boundaries defined by a river basin. The model is unlike most other simulation or human interaction models. It was not designed to accomplish any one specific purpose. Rather, it was devised to let its users represent the major decision--making processes which cause a regional system to function and change on a year-to-year basis. Described is the model, the development of a data base and the initiation of a game play. After discussing the economic, governmental and social sectors, the report deals with the following departments: assessment; planning and zoning; utility; school; highway; and bus and rail companies. An appendix lists general program error messages. (Bell-Cornell)
W78-09522

THE CHANGING CONTEXT OF WATER RESOURCES PLANNING: THE NEXT 25 YEARS,
Victoria Univ. (British Columbia). Dept. of Geography.
For primary bibliographic entry see Field 6B.
W78-09548

6B. Evaluation Process

USER ACCEPTANCE OF WASTEWATER SLUDGE COMPOST,
Culp/Wesner/Culp, Clean Water Consultants, El Dorado Hills, CA.
For primary bibliographic entry see Field 5E.
W78-09370

PLAYER'S GUIDE. THE RIVER BASIN MODEL.
Washington Environmental Research Center, DC. Environmental Studies Div.
For primary bibliographic entry see Field 6A.
W78-09522

TURNPIKE PROPERTIES FOR THE OPTIMAL USE OF A NATURAL RESOURCE,
Ecole des Hautes Etudes Commerciales, Montreal (Quebec).
A. Haurine, and N. M. Hung.
Review of Economic Studies, Vol. 44, No. 137, p 329-336, June 1977. 23 ref.

Descriptors: *Resource use, *Optimization, *Economics, *Turnpike properties, *Model studies, *Natural resources, Exhaustible resources, Inexhaustible resources, Replenishable resources, Economic growth, Production, Capital.

This paper deals with fundamental mathematical problems arising from consideration of natural resources in the neoclassical framework of optimal economic growth. Two problems are: (1) precise formulation of the turnpike property; and (2) definition and characterization of the optimality when the time interval is infinite, and formulation of existence conditions for such an optimal solution. The two problems appear linked by the important role played in both by an optimal steady state. No formal proof has yet been given for an extension of the turnpike property to the case of an optimum growth model where both capital and natural resources enter into the production process. Differences between capital and resource assets include: (1) Capital enters as stock inputs in the production process while the latter are often flow inputs (2) Capital depreciates over time and is reproducible through investment, while a natural resource is depleted by use and, when replenishable, reproduces itself according to a natural law. In this paper this extended turnpike property is proven for a continuous time model and expressed as a bound for the measure of the time spent away from the Von Neumann Set of the Economy. Results show that the resource asset, when replenishable, plays essentially the role of capital; thus, the turnpike property exhibited is not surprising. (Lynch-Wisconsin)
W78-09540

POLITICAL RESOURCE ALLOCATION, CONTROLLED AGENDAS, AND THE STATUS QUO,
Carnagie-Melon Univ., Pittsburg, PA. Graduate School of Industrial Administration.
For primary bibliographic entry see Field 6E.
W78-09541

RECREATION AND INSTREAM FLOW. VOLUME 1, FLOW REQUIREMENTS, ANALYSIS OF BENEFITS, LEGAL AND INSTITUTIONAL CONSTRAINTS.
Cortell (Jason M.) and Associates, Inc., Waltham, MA.
For primary bibliographic entry see Field 6E.
W78-09543

THE CHANGING CONTEXT OF WATER RESOURCES PLANNING: THE NEXT 25 YEARS,
Victoria Univ. (British Columbia). Dept. of Geography.
W. R. D. Sewell.
Natural Resources Journal, Vol. 16, p 791-805, October 1976. 2 fig.

Descriptors: *Future planning(Projected), *Water resources development, *Long-term planning, *Analytical techniques, Methodology, Model studies, Social aspects, Social needs, Technology, Institutions, Environmental effects, Water management(Applied), Canada, Conflict, Economic development, Resource allocation, International waters.

Successful water resource planning in the next 25 years will require a shift in perspective and improvements in analytical techniques to ensure that planning responds to the changing societal context. This paper describes a simple heuristic model of the social environment of water resources

planning, and relates concepts emerging from 50 years of planning to various social environments. The state of society model considers three factors: (1) needs, (2) technology, and (3) institutions. Social needs in primitive societies are defined largely in terms of biological survival, but with increasing societal complexity, material wants become progressively more important and finally psychological needs predominate. As societies progress from simple tools to sophisticated technology, basic biological needs can easily be satisfied but the institutionalization of science and technology tends to be geared to particular wants, and new needs may not be recognized or provided for. Technological innovations may therefore be increasingly out of phase with needs. Societal controls range from simple rules governing the individual's relationship to the group, to the complex institutions of modern society. As the locus of planning is scaled upward, these scales of these factors increase pressures on the resource base, cause growing conflicts in resource use, and disrupt the environment. Planners in the future must concentrate on improving: (1) assessment of demands, (2) assessment of alternatives, (3) institutional innovation, and (4) international cooperation. (Lynch-Wisconsin)
W78-09548

RECREATIONAL USE OF SOUTHERN MICHIGAN GAME AND RECREATION AREAS,
Michigan Dept. of Natural Resources, Lansing. Rose Lake Wildlife Research Center.
J. M. Lerg, and G. Y. Belyea.
The Michigan Academician, Vol. 10, No. 1, p 77-89, 1977. 4 fig, 2 tab, 10 ref. W-118-R.

Descriptors: *Michigan, *Recreation demand, *Hunting, *Wildlife management, *Surveys, *Competing uses, Recreation, Recreation facilities, Fishing, Public recreation areas, Boating, Multiple purpose, Camping, Sport fishing, Skiing, Hiking, Parks.

A questionnaire survey of users of state game and wildlife areas and state parks and recreation areas in southern Michigan December 1973-November 1974 showed that of 5.3 million man hours of recreation, 74% were devoted to nonhunting activities and only 26% to hunting. Fishing, the most common nonhunting use, took 29%. Hunting accounted for 62% in fall and 40% in winter. Recreational use of public lands in southern Michigan has approximately doubled since the mid-1960's but mostly in nonhunting activities which in turn may be competitively excluding, hunting. Hunters may be reluctant to compete with nonhunting recreationists since intrusions into hunting space are likely to result in reduced hunter satisfaction, reduced safety, or both. While recreation areas have traditionally emphasized nonhunting uses (though some are open to hunting), nearly all game areas are purchased and maintained with hunter-derived funds (hunting licenses, arms and ammunition taxes). As hunting is restricted mainly to fall and winter, the game areas are naturally available to other users the remainder of year, but resource managers must continue to provide hunting opportunities. To meet this objective, as well as to avoid overburdening the resource, future management efforts will probably include more intensive management of selected activities and increased efforts to exclude or limit undesirable activities. (Lynch-Wisconsin)
W78-09550

TOURISM, SUMMER SKI-ING, HYDROELECTRICITY AND PROTECTION OF THE PUBLIC IN THE FRENCH ALPINE GLACIAL AREA: THE DEVELOPMENT OF AN APPLIED GLACIOLOGY,
Grenoble-1 Univ. (France). Inst. de Geographie Alpine.
For primary bibliographic entry see Field 2C.
W78-09650

A RESEARCH STRATEGY FOR SOCIAL ASSESSMENT OF LAKE RESTORATION PROGRAMS,
Oregon State Univ., Corvallis. Dept. of Anthropology.
For primary bibliographic entry see Field 5G.
W78-09710

ANNOTATED BIBLIOGRAHY FOR WATER QUALITY MANAGEMENT, (FOURTH EDITION).
Environmental Protection Agency, Washington, DC. Water Planning Div.
For primary bibliographic entry see Field 5G.
W78-09760

U.S. RESERVOIR INVENTORY,
National Reservoir Research Program, Fayetteville, AR.
For primary bibliographic entry see Field 4A.
W78-09797

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

THE COST OF SUPPORTING RURAL WATER SYSTEMS,
Rural Water, Chicago, IL.
W. J. Molberg, Jr.
1976. 124 p, 12 fig, 20 tab, 2 append.

Descriptors: *Water supply, *Rural areas, *Water management(Applied), *Cost analysis, *Economics, *Operation and maintenance, Water policy, Forecasting, Costs, Water supply development, New Mexico, Florida, Virginia, Northern Rio Grande Development and Support Company(NM), Support costs, Planning, Model studies, National Demonstration Water Project.

This study of the costs of supporting rural water systems consists of a technical study of activities and associated costs and a discussion of policy implications. The study is part of the National Demonstration Water Project (NDWP). Results of extensive research in New Mexico and also in Virginia and Florida indicate that costs of operation and maintenance of rural water systems are increasing and may be beyond the means of local jurisdictions. Support of rural water facilities poses as serious a problem as development. This section provides a breakdown of operation and maintenance costs by activity, and a per-connection per-month cost figure is given for each unit. Total costs of the units is the minimum level for supporting a rural water system, found to be $4.50/connection/mo for a 700-connection system, and $7.50/connection/mo for a 45-connection system. These figures include field labor and nonlabor costs, administration and management labor and nonlabor costs, equipment reserves, and transportation. Data from various studies demonstrate that rural systems at present do not spend nearly what the model developed here requires to ensure long-term system survival. As support costs are likely to be high by urban standards, public policy must relieve this pressure through such measures as: (1) regional support organizations to service several small systems, and (2) reducing the debt service portion of the bill by economical system design and subsidies. (Lynch-Wisconsin)
W78-09542

6D. Water Demand

RECYCLING AND WATER QUALITY,
Geological Survey, Reston, VA. Water Resources Div.
H. R. Feltz.
In: Proceedings of the World Conference, Towards a Plan of Actions for Mankind, Vol 1, Long-Range Mineral Resources and Growth: Pergamon Press, New York, p 121-125, 1977. 3 tab, 3 ref.

Descriptors: *Water demand, *Water supply, *Water reuse, *Water quality, *Available water, Evaluation, *Water resources assessment, *World water supply.

The growing demands on the limited water supply of the world may be related directly to pressures created by an expanding global population and the consequent broadening industrial base and intensified agriculture. Wastes from these sources have degraded water quality and compound the problem of acceptable supply versus increasing demand. Evaluation of water-resources data in choosing the best courses of action consistent with judicious use and protection of the available water supply, has resulted in increased emphasis on recycling water. To fully assess the effects of recycling on water quality, for whatever water use, hydrologists will be obliged to consider the entire interdependent hydrologic system and to gather and evaluate truly comprehensive data. (Woodard-USGS)
W78-09316

RECREATIONAL USE OF SOUTHERN MICHIGAN GAME AND RECREATION AREAS,
Michigan Dept. of Natural Resources, Lansing. Rose Lake Wildlife Research Center.
For primary bibliographic entry see Field 6B.
W78-09550

CARRYING CAPACITY CONTROLS FOR RECREATION WATER USES,
Wisconsin Univ.-Madison.
J. A. Kusler.
Upper Great Lakes Regional Commission, Inland Lake Renewal and Shoreline Management Report, 1972. 71 p, 3 fig, 1 append.

Descriptors: *Recreation, *Lakes, *Regulation, *Carrying capacity, *Water management(Applied), *Wisconsin, Governments, Streams, Rivers, Conflict, Water sports, Administration, Legislation, Legal aspects, Judicial decisions, Shore protection, Multiple use, Ecology, Control, Planning.

As overcrowding of lakes and streams threatens public health and hampers recreational use, techniques are needed for limiting total water use to an assigned carrying capacity by means of water sport regulation and water access control devices. This paper discusses such measures, with special attention to problems of Wisconsin. State-wide programs are necessary, involving conjunctive action by state agencies and local governments, to plan and manage water and shoreland areas. Administrative and legal problems are considered, and a model statute designed to strengthen water and shoreland planning in Wisconsin is presented. Carrying capacity refers to the ability of a water body to accommodate various uses and numbers of users within defined levels of ecological disturbance and conflicts. Carrying capacities should be assigned for number of uses and users which would not seriously upset the ecological balance, or threaten users' safety and enjoyment. Limitation of surface water use has generally been a local function, involving surface time or zoning regulations. Many have been ineffective due to jurisdictional conflict, pressure from interest groups, or lack of money. The Wisconsin legislature should: (1) determine carrying capacity standards for particular uses, (2) prepare capability inventories and development plans, (3) modify zoning statutes, and (4) acquire shoreland properties for public management. (Lynch-Wisconsin)
W78-09551

WATER FOR INDUSTRIAL DEVELOPMENT IN GEORGE, HANCOCK, PEARL RIVER, AND STONE COUNTIES, MISSISSIPPI,
Geological Survey, Nashville, TN. Water Resources Div.; and Geological Survey, Jackson, MS. Water Resources Div.
J. V. Brahana, and G. J. Dalsin.
Mississippi Research and Development Center, Jackson, 1977. 70 p, 33 fig, 11 tab, 67 ref.

Descriptors: *Available water, *Surface waters, *Groundwater resources, *Water quality, *Mississippi, Water resources development, Planning, Industries, Water supply, Data collections, Streamflow, Aquifer characteristics, Water yield, Water analysis, Chemical analysis, *Industrial development, George County, Hancock County, Pearl River County, Stone County.

In southern Mississippi, George, Hancock, Pearl River, and Stone Counties have an abundant water supply. The water quality of the large streamflow and ground-water potential is very good, and little or no treatment is required for most industrial uses. Present water use is a small fraction of the total resource. In 1975, less than 8.5 million gallons per day was pumped from aquifers in the area, and there were virtually no known major withdrawals of surface water. The Pearl and Pascagoula Rivers could each supply at least 475 million gallons per day. The remaining eight streams in the area can supply at least 5 million gallons per day each without storage during a drought of 10-year recurrence interval. Miocene aquifers with aggregate freshwater sand thicknesses ranging from about 200 feet to more than 1,200 feet that underlie the entire four-county area are the most reliable sources of water. Large-diameter wells tapping the thicker sands should be capable of yielding several million gallons per day at many locations. The largest yield reported for a single well was 5,865 gallons per minute in Hancock County. (Woodard-USGS)
W78-09744

RATIONALISATION OF IRRIGATION RATES IN A DEVELOPING COUNTRY,
Central Water Commission, New Delhi (India).
For primary bibliographic entry see Field 3F.
W78-09761

6E. Water Law and Institutions

RECYCLING AND WATER QUALITY,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 6D.
W78-09316

WATER REORGANIZATION--AIMS, ACHIEVEMENT AND THE FUTURE,
Thames Water Authority, London (England).
For primary bibliographic entry see Field 5G.
W78-09424

EFFECT OF ENVIRONMENTAL REGULATIONS ON WATER MANAGEMENT IN (CZECHOSLOVAKIAN) PULP AND PAPER MILLS (VLIV VODOPRAVNICH PREDIPISU NA VODNI HOSPODARSTVI PAPIREN A LEPENKAREN),
For primary bibliographic entry see Field 5G.
W78-09511

POLITICAL RESOURCE ALLOCATION, CONTROLLED AGENDAS, AND THE STATUS QUO,
Carnagie-Melon Univ., Pittsburg, PA. Graduate School of Industrial Administration.
T. Romer, and H. Rosenthal.
Working Paper No. 86-75-76, Graduate School of Industrial Administration, Carnagie-Melon University, August 1977. 27 p, 2 fig, 11 ref, append.

Descriptors: *Political aspects, *Resource allocation, Agendas, *Decision-making, *Model studies, Institutions, Governments, Budgeting, Economics, Controlled agendas, Monopoly, Voting, Status quo, Taxes, Referenda, Administration.

A simple model of collective expenditure determination is analyzed to study decision-making through controlled agendas. The model corresponds to a situation widespread in local jurisdictions where public expenditures are determined by vote of the citizenry on a budget proposal formulated by a committee or bureau of public services. The budget proposal typically is subject to simple approval or defeat in a referendum. This paper focuses on a single vote on a tax-expenditure decision. The voters' choic is between the agnda-setter's proposal and the status-quo or fall-back position, and therefore the outcome of such of political resource allocation process depends to a great degree on the status quo, and intitutional and historical background. The 'setter's paradox' is discussed, in which a relatively high status-quo level of expenditure implies a relatively low level of final approved expenditures. The results are illustrated with cases from educational finance, public works projects, and implications for zero-base budgeting. Zero-base review and zero-base budgeting may tend, paradoxically, to increase the monopoly power of agencies, particularly appropriations for activities for which a majority of voters are unwilling to have the budgets go to zero. In this study it is assumed that the setter has a preference for the largest feasible expenditure. (Lynch-Wisconsin)
W78-09541

RECREATION AND INSTREAM FLOW. VOLUME 1, FLOW REQUIREMENTS, ANALYSIS OF BENEFITS, LEGAL AND INSTITUTIONAL CONSTRAINTS.
Cortell (Jason M.) and Associates, Inc., Waltham, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-275 269, Price codes: A08 in paper copy, A01 in microfiche. Bureau of Outdoor Recreation, July 1977. 96 p, 5 fig, 108 ref, 2 append. BOR-5-14-07-7.

Descriptors: *Recreation, *Legal aspects, *Streamflow, *Institutional constraints, *Rivers, Instream flow, Recreation demand, Streams, Methodology, Planning, Forecasting, Economics, Dams, Reservoirs, Water resources development, Boise River(ID), Bibliographies, Optimization.

Water requirements for instream recreation use, a methodology for evaluating impact of flow increments, and leal institutional constraints on use of instream rates for recreation were investigated. Very few water projects in the U.S. (such as dams) control water release to increase instream flow specifically for recreational purposes. The few that do are mainly located in the East, while in the drier West such releases are usually to dilute contaminant and support fish and wildlife. While instream flows for recreation cannot be guaranteed in specific cases planners can accurately determine the amount of water required, its value, and obstacles to be encountered. Physical instream conditions needed for various types of recreation are specified, in terms of width, depth, and flow velocity. Auxiliary site and longitudinal considerations affecting desirability of the activity are discussed. A technique using hydrology, hydraulic geometry, and limited field observations was developed to permit specification of minimum or optimum flow, and was tested on seven rivers in various parts of the country. Insuring the recommended flow means that recreation must compete directly with other consumers of stream water. This problem is analyzed with reference to evaluation criteria imposed by the U.S. Water Resources Council's 'Principles and Standards.' An annotated bibliography is included. (Lynch-Wisconsin)
W78-09543

CARRYING CAPACITY CONTROLS FOR RECREATION WATER USES,
Wisconsin Univ.-Madison.
For primary bibliographic entry see Field 6D.
W78-09551

CODIFIED AND UNCODIFIED STATE LAWS AND AGENCY RULES AND REGULATIONS BEARING ON WATER AND RELATED LAND RESOURCES IN MINNESOTA, VOLUME 1.
Minnesota Univ., St. Paul. Water Resources Research Center.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-284 103, Price codes: A99 in paper copy, A01 in microfiche. WRRC Bulletin 98, June 1978. 685 p. Compiled by A. W. LaChapelle. OWRT A-999-MINN(47), 14-34-0001-8025.

Descriptors: Legislation, Regulations(Law), Planning, Management, *Minnesota, *Water law, *Administration, Land resources.

This publication is a source reference for lawmakers, administrators, planners, lawyers, engineers, and others interested in water resource use, development, and management. It contains a compilation of all pertinent (1) codified state laws as of fiscal year 1977. The codified laws are contained entirely in Volume 1 along with an Analytical Table of Chapters of included statutory material while Volume 2 will contain the uncodified enactments and agency rules and regulations. And finally the entire work is intended to be self-contained. All textual material of Minnesota statutes, regulations or documents referred to in the text is incorporated into the bulletin as appropriate unless notated otherwise. Textual material of foregin or federal statutes, regulations, treaties or documents is not included as it is beyond the scope of this work. (Waelti-Minnesota)
W78-09571

AN INTRODUCTION TO FOUR OVERVIEWS: ARID AND SEMI-ARID LANDS; SOIL LOSS; TROPICAL FORESTS AND WOODLANDS; WATER QUALITY,
United Nations Environment Program, New York.
For primary bibliographic entry see Field 6G.
W78-09657

RAUSER V. TOSTON IRRIGATION DISTRICT (NO SHOWING OF NEGLIGENCE NECESSARY TO RECOVER FOR INVERSE CONDEMNATION).
565 P. 2d 632-642 (Mont., 1977).

Descriptors: *Montana, *Condemnation, *Irrigation effects, *Flooding, Irrigation districts, Drainage systems, Drainage effects, Irrigation water, Negligence, Seepage, Adjacent landowners, Legal aspects, Land tenure, Damages, Eminent domain, Land appraisal, Judicial decisions, Easements, Constitutional law, Real property.

Plaintiff landowners brought an inverse condemnation proceeding against defendant irrigation district. The plaintiffs claimed that construction of an irrigation project by the defendant had resulted in seepage which caused water to stand stagnant on 40 acres of their land and that this amounted to the taking of a flood easement. At trial, the plaintiffs received a $100,000 judgment. On appeal, the Montana supreme court decided that when damages are known or are ascertainable and are an inevitable result of a project, there is no need to show negligent design, construction, or operation to recover on inverse condemnation. In affirming the trial court, the supreme court ruled that five factors were to be considered in inverse condemnation suits: (1) property damage if reasonably foreseeable, and whether it would have entitled the property owner to compensation; (2) the likelihood of future public works projects not

being engaged in; (3) whether direct physical damage resulted from the project; (4) whether the cost of the damage can be borne easier by the taxpayers than by the private owner; (5) and whether the private owner would contribute more than his proper share to the undertaking if uncompensated. (Maass-Florida)
W78-09683

MELVILLE V. SALT LAKE COUNTY (LANDOWNER'S RIGHT TO APPROPRIATE SPRING WATER).
570 P. 2d 687-689 (Utah, 1977).

Descriptors: *Utah, *Water allocation(Policy), *Appropriation, *Percolating water, *Domestic use, Legal aspects, Water contracts, Water policy, Prior appropriation, Water law, Water rights, Beneficial use, Surface runoff, Subsurface waters, Bodies of water, Mine water, Spring waters, Zoning, Regulation, Springs.

Plaintiff landowners appealed from a judgement of the district court dismissing their complaint for writs of mandamus to compel the county to issue building permits, which had been denied on the grounds that the landowners did not have an adequate source of culinary water. Plaintiff's source of water was a spring on the land of a non-party plantiff which produced twenty gallons of water per minute. The flow was adequate to meet plaintiff which produced twenty gallons of water per minute. The flow was adequate to meet plaintiff's needs by county health standards. The state supreme court held that, in addition to proving that they had an adequate source of water, plaintiffs must further show that they have a right to use the water. Plaintiffs alleged that since the water in question was percolating water, it belonged to the owner of the land. The court held that the water did not fit into the definition of percolating water, and therefore was subject to appropriation. Since the plaintiffs could only establish that they had a right to 50 gallons of water per day per unit, the court found that they were not entitled to the permit because the board of health requirement of 400 gallons per day per unit was not met. (Beamer-Florida)
W78-09684

SAXON V. DIVISION OF STATE LANDS (DENIAL OF PERMIT APPLICATION TO FILL SALTMARSH).
31 Or. App. 511, 570 P.2d 1197-1201 (1977).

Descriptors: *Oregon, *Permits, *Landfills, *Environmental control, *Saltmarshes, Administrative decisions, Regulation, Administration, Land use, Non-structural alternatives, Water law, Real property, Water resources, Natural resources, Legal aspects, Judicial decisions, State governments, Protection, Legal review, Estuarine environment.

Plaintiff appealed a decision of the defendant state agency, reached after a hearing, denying him a permit to fill acres of salt marshland of the Siuslaw River Estuary in order to construct a campground, restaurant, and marina. The appellate court outlined the role of the saltmarsh in providing spawning grounds and habitat for fish. The court also noted the saltmarsh's important function in flood control and pollution assimilation. Denying the appeal, the court held that Oregon's Removal and Fill law provides for the protection, conservation, and best use of Oregon's water resources, and together with the defendant agency's rules sets forth ascertainable standards for allowance or denial of fill applications. In addition, the court held that there was substantial evidence in the record to support the defendant agency's conclusion that the public interest in the best use of its water resources was better served by retaining plaintiff's saltmarsh in its unimproved state. Finally, the court noted that the issue of inverse condemnation would have to be raised in a separate proceeding. (Hoofman-Florida)
W78-09685

BRUSCO TOWBOAT CO. V. STATE (VALIDITY OF LEASE PROGRAM FOR SUBMERGED LAND).
31 Or. App. 491, 570 P. 2d 996-998 (1977).

Descriptors: *Oregon, *Beds, *Navigable waters, *Leases, *Structures, Legislation, Bodies of water, Navigation, Ownership of beds, Riparian rights, Legal aspects, Rent, Permits, Riparian land, Land, Water law, State jurisdiction.

Three consolidated cases raised the issue of the validity of the State Land Board's program under which users were required to enter into leases and pay rent for the use of submerged and submersible lands underlying navigable waterways in the state. The circuit court upheld the program. The apellate court appeals reversed in part. On petition for reconsideration, the appellate court held that the riparian owners who had exercised the right to erect navigational structures on state-owned submerged and submersible lands prior to the effective date of the State Land Board's program were all, without regard to the public nature of some of them, entitled to the benefit of estoppel arising from exercised affirmative leases. The court limited the Board's power to revoke riparian licenses to erect navigation structures by the licensee's right to recover unrecouped investments. The court further held that the fact that some of the riparian owners were lessees under a prior similar program of the state might affect the cutoff period for recoupment for them and might therefore be relevant in computing their appropriate period of free rental. However, it would not affect the applicability of estoppel. (Beamer-Florida)
W78-09686

BRUSCO TOWBOAT CO. V. STATE, BY AND THROUGH STRAUB (AUTHORITY OF STATE TO REQUIRE THE PAYMENT OF RENT FOR USE OF SUBMERGED AND SUBMERSIBLE LAND UNDER NAVIGABLE WATERS).
30 Or. App. 509, 567 P. 2d 1037-1051 (1977).

Descriptors: *Oregon, *Leases, *Navigable waters, *Riparian rights, *Submerged Lands Act, Legal aspects, Land, Land use, Rent, Structures, State jurisdiction, Eminent domain, Legislation, Permits, State governments, Land resources, Riparian land, Riparian waters.

In three consolidated cases, plaintiffs, various tugboat and plywood companies, riparian landowners and several port districts, challenged the validity of Oregon's State Land Board's program requiring users to enter into leases for the use of state-owned submerged and submersible lands underlying navigable waterways throughout the state. Uses which are essentially navigational and wharfing privileges by riparian owners were exempted from the program. Plaintiffs contended that the program is beyond the Board's statutory authority and violates both the Oregon and United States Constitutions. Plaintiffs further contended that the state's proprietary interest in the land does not empower it to convey leasehold interests to private parties. Riparian land owners argued that the charging of rent on structures built on submerged land was an unlawful taking of property. Plaintiff port districts contended that due to legislative delegation of authority, the program should not apply to them. The Court of Appeals upheld the program as applied to all plaintiffs, but held that riparian owners were entitled to use structures built before the effective date of the program for as long as reasonably necessary to recoup expenses. (Quarles-Florida)
W78-09687

MORE V. JOHNSON (RIPARIAN OWNER'S RIGHT TO BED OF STREAM).
568 P. 2d 437-441 (Colo., 1977).

Descriptors: *Colorado, *Streams, *Riparian rights, *Non-navigable waters, *Boundaries(Property), Bodies of water, Riparian land, Water law, Legal aspects, State governments, Trespass, Beds, Adjacent landowners, Boundary disputes, Banks, Rivers.

Plaintiff riparian landowners filed suit against adjoining landowners and an engineer to quiet title to certain real estate and to obtain damages for trespass and conspiracy to commit trespass. Both plaintiff and defendant held title derived from a common grantor to land bordering a creek. The general rule of law followed by the state is that a deed conveying land bordered by a non-navigable stream includes the bed to the center or thread of the stream if the stream is described in the deed as a boundary or monument. The district court followed the general rule and quiet title to the center of the bed of the stream in the plaintiffs. A $15,000 judgement was rendered to the plaintiffs and attorneys' fees were awarded. The state supreme court held that the wording of the plaintiff's deed made the general rule of ownership inapplicable. The court held further that proof of an agreement to trespass between the engineer and the adjoining landowners would not be inferred; it would have to be proven. In addition, the statutory award of attorney's fees, without reciprocal rights for a successful defendant, was found to be a denial of equal protection. (Beamer-Florida)
W78-09688

MOE V. DIVISION OF STATE LANDS (RIGHT TO FILL SUBMERGED LAND).
31 Or. App. 3, 569 P. 2d 675-677 (1977).

Descriptors: *Oregon, *Landfills, *Permits, *Beds, *Conservation, Legal aspects, Administrative agencies, Legislation, State governments, Regulation, Aquatic life, Fish conservation, Water resources, Bodies of water, Fish, Freshwater fish, Aquatic habitats, Wildlife conservation, Dredging, Salmonids.

The petitioners sought a reversal of an order granting the Port of Hood River a permit to fill submerged land on the ground that, as a matter of law, the order granting the permit was contrary to the statutory standards set forth in the relevent state statute. The Port had acquired title to the submerged land in question and to adjacent lands to create an industrial park. The rest of the land was filled before a law requiring a permit to fill submerged land was passed. When the Port applied for the required permit for the land in question, the application was denied. The decision was contested and the Director of State Lands granted the permit. He found that there were 'special circumstances' which made this a unique situation. Although the previous fill operations had resulted in increased fishery values that needed environmental protection, the substantial commitment of time and money by the Port toward the project in 1967 and the fact that the fisheries were a result of the Port's work made this a unique situation. The appellate court reversed finding that the Director had gone beyond this authority in finding 'special circumstances.' (Beamer-Florida)
W78-09689

BOHN V. KUIPER (PROOF OF AUGMENTATION PLAN REQUIRED BEFORE PERMIT ISSUANCE).
575 P. 2d 402-403 (Colo., 1978) (rehearing denied March 13, 1978).

Descriptors: *Colorado, *Water allocation(Policy), *Well permits, *Prior appropriation, *Relative rights, Appropriation, Priorities, Preferences(Water rights), Water distribution(Applied), Competing uses, Irrigation practices, Legal aspects, Water control, Water demand, Water rights, Permits, Irrigation permits, Legislation, Administrative agencies, Control.

Applicant proposed to drill an irrigation well. The state engineer denied the well permit on the grounds that he was unable to find any available unappropriated water, and was unable to find that vested water rights of senior appropriators would not be materially damaged by use of water from the applicant's well. Applicant then applied to the water court for a conditional decree authorizing well construction. The water court granted a conditional right to well operation if the applicant would provide proof of an approved plan of augmentation as mandated by the amended rules and regulations of the state engineer. A 'plan for augmentation' means a detailed program to increase the supply of water available for beneficial use. The state engineer appealed the conditional decree. The appellate court found that the applicant had not submitted his own augmentation plan, nor shown that he had joined any organization which had an approved plan for augmentation. Reversing the conditional decree, the appellate court held that a plan of augmentation must be shown before any conditional decree could be awarded. Otherwise, anyone desiring to drill a well could obtain such a conditional decree. (Baumbach-Florida)
W78-09690

CITY OF THORNTON V. FARMERS RESERVOIR AND IRRIGATION COMMPANY (HOME RULE MUNICIPALITY'S POWER TO CONDEMN WATER RIGHTS).
575 P. 2d 382-395 (Colo., 1978) (Rehearing denied March 6, 1978).

Descriptors: *Colorado, *Cities, *Eminent domain, *Water rights, *Municipal water, Condemnation, Legal aspects, Water law, State governments, Constitutional law, Judicial decisions, Legislation, Competing uses, Compensation, Political aspects, Ditches, Regulation.

Plaintiff, a home rule municipality, sought to condemn certain water and water rights and ditches and ditch rights of defendant mutual ditch company. Plaintiff contended that it waa not subject to the provisions of the Water Rights Condemnation Act of 1975 which requires that necessity be determined before eminent domain proceedings can be exercised. Plaintiff relied on Article XX of the Colorado Constitution which provides that a home rule municipality shall have the power to condemn and purchase water works. Defendant argued that determination of necessity was a matter of statewide concern, and therefore, home rule municipalities were subject to statutory limitations provided in the Condemnation Act. Defendant further contended that the constitutional grant of power to condemn water works did not include water rights. The court held for the plaintiff, stating that the plaintiff could exercise its condemnation powers granted by the constitution and that the term 'water works' includes the water rights necessary to operate the works. Therefore, the condemnation of water rights by the home rule municipality was found not to be a matter of statewide concern, requiring statewide regulation. (Curtis-Florida)
W78-09691

COUNTY OF BUCKS V. .800 ACRES OF LAND IN TOWNSHIP OF MIDDLETOWN, COUNTY OF BUCKS (POSSESSION BY CONDEMNOR NECESSARY TO EFFECT A TAKING).
Pa. Cmwlth., 379 A. 2d 903 (1977).

Descriptors: *Pennsylvania, *Eminent domain, *Dam construction, *Spillways, Condemnation, Legal aspects, Value, Cost repayment, Payment, Easements, Right-of-way, Compensation, Water law, Alteration of flow, Artificial use, Flood control, Recreation, Legislation, Sites, Overflows.

In anticipation of constructing a recreation and flood control dam, the county acquired a perpetual right and easement to occasionally overflow, flood and submerge owners' lands. Such right was acquired by filing a 'declaration of taking', that is by condemning the owners' land. The lower court awarded delay compensation to the condemnees from the date of filing the declaration of taking and the county appealed. In reversing, the appellate court found that the lower court erred in holding that possession by the county was not necessary to effectuate a taking of the property involved. The court found that such possession was necessary, and that possession would occur through the flooding of appellees' property following construction of the dam. The fact that this flooding will take place only occasionally at undetermined future times was considered irrelevant. Since possession by county had not yet occurred, the owners were judged not entitled to delay compensation. (Baumbach-Florida)
W78-09692

ROBINSON V. ARIYOSHI (ENGLISH COMMON LAW DOCTRINE OF RIPARIAN RIGHTS FOUND NOT TO GOVERN THE USE OF HAWAII'S STREAM WATERS).
441 F. Supp. 559-587 (D. Hawaii, 1977).

Descriptors: *Riparian rights, *Alteration of flow, *Surface water availability, *Water allocation(Policy), Water rights, Legal aspects, Surface waters, Common law, Constitutional law, Irrigated land, Riparian land, Streamflow, River flow, Diversion, Streams, Water law, Compensation, Hawaii, Irrigation.

Plaintiffs, individuals and companies which had been party to state supreme court proceedings, brought action to enjoin state officials from interfering with transportation and use of river waters for irrigation purposes. Plaintiffs also moved for declaratory judgment that the prior decision was void to the extent that it adjudicated all flowing surface waters to be property of the state, subject only to appurtenant water rights, and adjudicated that rights to ancient appurtenant water cannot be separated from ownership of the land. Plaintiffs also sought declaratory judgment that water awarded to them could be transported out of the watershed, and that the English common law doctrine of riparian rights does not govern the use of Hawaii's stream waters. The district court held that there was no applicable federal common law regarding appurtenant water rights; that the decision of the Hawaii Supreme Court had denied procedural due process since the parties had no opportunity to argue the issues of the decision; and that the decision retroactively converted private property rights in water to public property rights, thus resulting in an unconstitutional taking of property without compensation. (Rule-Florida)
W78-09693

PACIFIC LEGAL FOUNDATION V. QUARLES (POWER OF ENVIRONMENTAL PROTECTION AGENCY TO FORMULATE CONDITIONS FOR NATIONAL POLLUTANT DISCHARGE SYSTEM PERMIT).
440 F. Supp. 316-328 (C.D. Cal., 1977).

Descriptors: *Waste water treatment, *Waste water disposal, *Sewage treatment, *Federal Water Pollution Control Act, Water law, Water purification, Sludge disposal, Waste water(Pollution), Waste disposal, Sewage effluents, Sewage sludge, Municipal wastes, Sewage, Landfills, Oceans, Permits.

Plaintiff legal foundation requested an injunction to stop implementation of wastewater treatment plant's interim sludge disposal project which called for de-watering of sludge and transportation to a sanitary landfill, on the ground that the project would result in substantial land-based environmental consequences. Plaintiff alleged that the Environmental Protection Agency (EPA) supported the project relying on the untested assumption that ocean disposal of sludge is more harmful than disposal on land. Plaintiff requested the injunction until preparation of two environmental impact statements; one for a contemplated EPA grant to fund the project, and another for the EPA's national policy against disposal of sludge into the ocean. Plaintiff also sought a declaration that the Federal Water Pollution Control Act does not prohibit ocean disposal of sludge and hence any impact statement for the project should consider ocean disposal. In denying the injunction, the district court held that as long as there existed a practical land disposal method, the EPA was not required to evaluate the alternative of ocean dumping when it formulated conditions for a national pollutant discharge elimination system, or when it authorized a grant to develop a project designed to achieve compliance with the Act. (Rule-Florida)
W78-09694

SOLE OR PRINCIPAL SOURCE AQUIFER AREAS.
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
For primary bibliographic entry see Field 5G.
W78-09695

CARBON BLACK MANUFACTURING POINT SOURCE CATEGORY EFFLUENT GUIDELINES AND STANDARDS.
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 5G.
W78-09696

DEEP OCEAN MINING.
National Oceanic and Atmospheric Administration, Washington, DC.
Federal Register, Vol. 42, No. 239, p 62521-23, December 13, 1977.

Descriptors: *Mining, *Beds under water, *Oceans, *Mineral industry, Industries, On-site investigations, Research development, Hydraulic mining, Toxins, Regulation, Manganese, Deepwater habitats.

These environmental guidelines concerning deep ocean mining are based on preliminary results of the National Oceanic and Atmospheric Administration's (NOAA) Deep Ocean Mining Environmental study (DOMES 1). The guidelines provide an early indication of key areas of environmental concern in the development of deep ocean mining for manganese nodules. Bills which would establish regulatory regimes for deep-sea mining are presently before Congress. Several multinational organizations are actively engaged in premining research and development activities. Testing of prototype mining systems has already begun. Two main types of mining systems are being developed: hydraulic and mechanical. The NOAA foresees creation of perhaps four to six mining operations. The guidelines for mining operations include: (1) creation of discharge methods that will minimize environmental impacts; (2) conduction mining activities which will allow preservation of benthic communities and habitats; (3) elimination of exogenous and indigenous materials identified as toxic or deleterious; (4) determination of mining sites based on potential impacts on humans and biota; and (5) conducting on-going environmental studies at every mining site. Environmental studies should include participation of both government and industry. (Spiegel-Florida)
W78-09697

IMPLEMENTATION OF SECTION 208 IS FINALLY UNDERWAY: ENVIRONMENTAL LAW INSTITUTE WILL ASSIST BY PREPARING HANDBOOK FOR DESIGNATED AGENCIES.
For primary bibliographic entry see Field 5G.
W78-09698

SECTION 1424 (E) OF THE SAFE DRINKING WATER ACT: AN EFFECTIVE MEASURE AGAINST GROUNDWATER POLLUTION,
For primary bibliographic entry see Field 5G.
W78-09699

STATE'S RIGHTS REVISITED: THE NINTH CIRCUIT LEADS THE BUREAU OF RECLAMATION TO WATER.
Environmental Law Reporter, Vol. 7, No. 7, p. 10127-10130 (July, 1977).

Descriptors: *Water resources development, *Federal Reclamation Law, *Federal-state water rights conflict, *Water allocation(Policy), Judicial decisions, Legal review, Federal government, State governments, Competing uses, Governmental interrelations, Water law, Planning, Prior appropriation, Permits, Dams, Rivers.

A substantial setback to state efforts to plan water allocation has resulted from a 1977 Ninth Circuit Court of Appeals decision. In United States v. California, the court held that the Federal Bureau of Reclamation need not comply with state water permit restrictions when it obtains unallocated waters. In effect, this will allow the federal government to obtain unallocated waters regardless of state conservation priorities. The author criticizes the court ruling as not properly considering the legislative intent behind the Reclamation Act of 1902, and feels that the court erred in relying on a United States Supreme Court ruling in Hancock v. Train, in which the Court held that Congress did not intend to include fedeal installations within a state's primary responsibility for assuring air quality in a region. The ninth circuit, applying this holding, ruled that although the federal government is supposed to proceed in conformity with state water laws, this duty is limited only to those laws that came into existence before passage of the Reclamation Act. The article concludes that it will require Supreme Cour clarification to rectify this case law application trend. (Stump-Florida)
W78-09700

POWER PLANT SITING ON WISCONSIN'S COASTS: A CASE STUDY OF DISPLACEABLE USE,
Wisconsin Univ.-Madison. Center for Resource Policy Studies and Programs.
For primary bibliographic entry see Field 6G.
W78-09701

CURRENT INTERNATIONAL ISSUES RELATING TO THE LAW OF THE SEA,
United Nations Permanent Mission of Cameroon, New York.
P. B. Engo.
Natural Resources Lawyer, Vol. 4, No. 3, p 622-628 (1971).

Descriptors: *Continental shelf, *International law, *Law of the sea, *United Nations, United States, Africa, Foreign countries, Foreign waters, Oceans, Oil industry, International waters, Political aspects, Canada, Coasts, Governments, Governmental interrelations, Jurisdiction, Regime, Beds under water, Boundary disputes.

This article is the text of a paper presented in 1971 in Houston, Texas in connection with the Offshore Technology Conference. Examined are problems then plaguing the United Nations Special Committee on the Sea Bed responsible for preparing materials for the 1973 Law of the Sea Conference. The author recommends that so-called 'big' countries like the United States must not reject the active participation of younger states, especially African states, in creating an international regime for governing use of the seabed. The author criticizes adherence to the anachronistic concept of absolute sovereignty, the 1958 Convention on the Continental Shelf which had included only a handful of African states, isolationist policies, and the use of industrial advancement rather than economic and technological potential as the basis for determining the relative strengths of nations. Joint cooperation through the United Nations could lessen the danger of war. The involvement of United States oil companies in the economic development of young states is a model for further cooperation. The author notes that neither developed nor less developed countries can do without each other, and suggests that opinions of scientific experts should guide the formation of an international regime. (Smith-Florida)
W78-09702

FEDERAL NAVIGATION SERVITUDE: SHOULD IT BE A TOOL FOR WETLANDS PROTECTION,
S. A. Fraser, IV.
Detroit College of Law Review, Vol. 1977. No. 1, p 111-133 (Spring, 1977).

Descriptors: *Navigable waters, *Wetlands, *Federal jurisdiction, *Constitutional law, *Protection, Watersheds(Basins), Water law, Rivers and Harbors Act, Federal Water Pollution Control Act, Navigable rivers, Navigation, Meanders, Natural streams, Coastal marshes, Compensation, High-water mark, Judicial decisions, Legal aspects, Regulation, State governments.

The need for protection of the nation's wetlands has been recognized by all branches of the federal government. The author believes that protection can best be obtained from the federal government. The United States Army Corps of Engineers has been the guardian of navigable waters under a doctrine labeled navigational servitude based on the Commerce Clause of the Constitution. Under this doctrine the federal government asserts a superior right to navigable waters and in some cases the underlying land. When operating pursuant to the doctrine, the federal government has historically not paid compensation for the taking of private property. The author examines the historical development of federal jurisdiction through the expansion of the doctrine from coverage of waters strictly navigable in fact to all wetlands up to and including marshlands above the mean high-water line. The author concludes that the doctrine of navigational servitude cannot reasonably be used to justify the extension of federal jurisdiction to regulate nonnavigable marshlands for environmental purposes without paying compensation to landowners whose property rights are affected. (Wright-Florida)
W78-09703

INDIAN PUEBLO WATER RIGHTS NOT SUBJECT TO STATE LAW PRIOR APPROPRIATION,
R. R. O'Brien.
Natural Resources Journal, Vol. 17, No. 2, p 341-344 (April, 1977).

Descriptors: *New Mexico, *Prior appropriation, *Indian reservations, *Reservation doctrine, *Pueblo water rights, State jurisdiction, Water rights, Preferences(Water rights), Water law, Riparian rights, Appropriation, Irrigation water, Water utilization, Competing uses, Beneficial use, Priorities, Civil law, Legal aspects, Federal jurisdiction, Public lands, Federal reservations, Political aspects.

In 1966, New Mexico brought suit to determine the rights to the use of water of the Nambe-Pojoague River system. The district court held that the Indians' rights to water use were controlled by the state law doctrine of prior appropriation, meaning that the individual with the greatest priority has the better right to the water. On appeal, the United States and the Indians argued that the Indians had a reserved right that was prior to those rights of non-Indians and that they had a reserved right to the use of as much water as they needed to irrigate their land. The state argued that whatever rights the Indians had were lost by the Pueblo Land Acts of 1924 and 1933 which quieted title to lands of uncertain ownership. The appellate court held that the Indians' right to the use of this water was not governed by state law based on the doctrine of prior appropriation since the U.S. had never surrendered its jurisdiction and control. The court found that the language of the public Land Acts indicated that the Indians had a reserved right to the use of the water. (Maass-Florida)
W78-09704

LAW OF THE SEA: BREAKING THE DEADLOCK,
Vanderbilt Univ., Nashville, TN. School of Law.
J. I. Charney.
Foreign Affairs, Vol. 55, No. 3, p 598-629 (April, 1977).

Descriptors: *International law, *Law of the Sea, *Oceans, *United Nations, *Resources, Water law, Water rights, Water conservation, Seas, Continental shelf, Jurisdiction, Political aspects, Legislation, Planning, Riparian rights, Water policy, Regulation, Mining, International waters.

The negotiations at the Third United Nations Law of the Sea Conference are aimed at preparing a comprehensive and universally acceptable Convention of the Law of the Sea. The negotiations are deadlocked over three critical issues: (1) the legal status of the agreed 200-mile economic zone; (2) a regime for exploiting the resources of the deep seabed; and (3) the rights of landlocked and geographically disadvantaged states. The economic issues have become increasingly linked to the broader objectives of the developing nations. On the seabed issue in particular, there is a marked developed nations against the developing nations character to the opposing sides. The greatest danger threatening the negotiations with failure comes from the United States, and specifically from the likelihood of congressional action asserting a United States right to exploit the deep seabed under congressionally set terms. Inescapably, these Law of the Sea negotiations pose the broader issue of world order. The problem of the oceans is only one of a number of universal issues that may require multilateral solutions. The author suggests that the failure of the Conference participants to reach an agreement will result in destabilizing, illegitimate unilateral actions detrimental to all in the long run. (Jordan-Florida)
W78-09705

WHO WILL OWN THE OCEANS,
J. T. Swing.
Foreign Affairs, Vol. 54, No. 3, p 527-546 (April, 1976).

Descriptors: *Oceans, *Law of the Sea, *International waters, *United Nations, *International law, Riparian rights, Continental shelf, Water law, Continental slope, Bodies of water, Seas, Navigation, Commercial fishing, Water pollution control, Foreign waters, Oil industry, Regulation, Resources, Foreign countries.

Competition for control over the oceans has increased dramatically in the twentieth century. Realizing in 1945 that offshore oil would become important, the United States unilaterally reserved exploration rights of the continental shelf. Other unilateral declarations followed and to reconcile the newly asserted rights the United Nations has held conferences to clarify the Law of the Sea. The major issues before the Third Conference are: a 12-mile territorial limit; an exclusive economic zone extending 188 miles beyond that; and whether the area beyond 200 miles, including the waters, the seabed and the resources, will be subject to the jurisdiction and control of an international organization not yet established. The conflict between freedom of navigation and protection of the marine environment and who will control the oil resources beneath the sea will also be con-

sidered. In these issues there is a conflict between the developing and industrial nations. The article concludes that the need for unhampered scientific research must be balanced against the strong drive for sovereignty in the 200 mile limit and that a treaty is necessary. (Maass-Florida)
W78-09706

WATER POLLUTION CONTROL: AN OVERVIEW OF THE LAWS,
Environmental Protection Agency, Washington, DC. Water Planning and Standards.
For primary bibliographic entry see Field 5G.
W78-09707

U.S. OCEANS POLICY: THE TRUMAN PROCLAMATIONS,
Johns Hopkins Univ., Washington, DC. Ocean Policy Project.
A. L. Hollick.
Virginia Journal of International Law, Vol. 17, No. 1, p 23-55 (Fall, 1976).

Descriptors: *Continental shelf, *Oceans, *Boundary disputes, *International law, *Coasts, Continental slope, Continental margin, Marine geology, Political aspects, Resources, Political constraints, Federal government, Jurisdiction, Water law, Water rights, Legal aspects, Geomorphology, Foreign countries.

In 1945, the United States government issued two proclamations. One asserted jurisdiction and control over the natural resources of the continental shelf. The second declared the United States' right to establish conservation zones for the protection of fisheries in certain areas of the high sea contiguous to the United States. These proclamations were issued to expand United States control over offshore resources including fish and oil. The history of the proclamations is traced from their origins in the interior Department to the Justice Department where the Secretary of the Interior pressed the Attorney General to institute suit to determine the rights of the federal government against the coastal states. After numerous consultations, President Truman signed and issued the proclamations in spite of much opposition. After their issuance, several countries likewise extended their territorial waters. As a world power, the United States could have secured internation agreement to the substance of the proclamations and thereby strengthened its hand in dealing with those nations which might subsequently have pressed excessive offshore claims. (Maass-Florida)
W78-09708

FEDERAL LAW, IRRIGATION AND WATER POLLUTION,
For primary bibliographic entry see Field 5G.
W78-09724

FLOOD PLAIN MANAGEMENT, FOR OREGON CITIES AND COUNTIES.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
For primary bibliographic entry see Field 6F.
W78-09725

FEDERAL GROUNDWATER RIGHTS: A NOTE ON CAPPAERT V. UNITED STATES,
Stanford Univ., CA., School of Law.
For primary bibliographic entry see Field 4B.
W78-09726

TOWARD CLEAN WATER: A GUIDE TO CITIZEN ACTION.
Conservation Foundation, Washington, DC.
For primary bibliographic entry see Field 5G.
W78-09727

RELATION OF POLITICAL BOUNDARIES ON THE OCEAN FLOOR TO THE CONTINENTAL MARGIN,
Princeton Univ., NJ. Dept. of Geology.
H. D. Hedberg.
Virginia Journal of International Law, Vol. 17, No. 1, p 57-75 (Fall, 1976).

Descriptors: *Continental margin, *Boundaries(Property), Resources, *International law, *Oceans, Continental shelf, Structural geology, Boundary disputes, Jurisdiction, Political aspects, Government interrelations, Water law, Water rights, Legal aspects, Continental slope, Geologic mapping.

The continental margin, the outer edge of the partially submerged continental mass where it intersects the ocean floor, has political significance as does the continental shelf. Several unsatisfactory proposals have been put forth to determine the delimitation of the area. The most logical proposal is for a boundary zone extending from an agreed landward base proceeding oceanward for an internationally specified distance within which the precise boundary would be drawn. This allows for the uncertainty of the base of the continent, allows for the use of a zone, and allows the final designation of the boundary to be made by coastal states which may agree to stipulate the width of the margin. Agreement on the scope of this area is critical to the Law of the Sea Conference since it has been proposed as the controlling factor of the oceanward boundary of coastal states' rights over natural resources. The boundary zone should be determined by an International Marine Commission. The precise boundary line would be drawn by the coastal state itself subject to the Commission's approval, and would apply only to natural resources. (Maass-Florida)
W78-09728

DELIMITATION OF CONTINENTAL SHELF JURISDICTION BETWEEN STATES: THE EFFECT OF PHYSICAL IRREGULARITIES IN THE NATURAL CONTINENTAL SHELF,
G. R. Feulner.
Virginia Journal of International Law, Vol. 17, No. 1, p 77-105 (Fall, 1976).

Descriptors: *Continental shelf, *Oceans, *Coasts, *International law, *United Nations, Water resources development, Geology, Governmental interrelations, Boundaries(Property), Continental slope resources, Continental margin, Marine geology, Boundary disputes, Political aspects, Legal aspects, Water law, Water rights, State jurisdiction.

The evolution of continental shelf jurisdiction as a legal doctrine began with the 1945 Truman Proclamations which called for United States control over its continental shelf. Following the Truman Proclamations were the Convention on the Continental Shelf and the North Sea Continental Shelf Cases. A delimitation of the continental shelf involves the conflicting rights of two states where they are either adjacent or opposite neighbors. After analyzing the characteristics of the continental shelf beneath the Gulf of Maine and the East China Sea, it became apparent that an interpretation of the natural prolongation of the shelf which emphasizes its geologic character is most consistent with the historic justification for national jurisdiction over the continental shelf. However, in a case like the Gulf of Maine with its major irregularities, the concept of natural prolongation is impossible to apply. Delimitation would be best determined by reference to the historical use of the area by the parties or by merely setting a mileage limit. Also the definition in the negotiating text of the Law of the Sea Conference, which limits the shelf to 200 miles from the coast, should be subordinate to the natural prolongation concept. (Maass-Florida)
W78-09729

WATER CONFLICTS FROM THE VIEWPOINT OF A REGULATION,
Utah State Engineers' Office, Salt Lake City.
For primary bibliographic entry see Field 3E.
W78-09730

TIDELANDS: TRUSTS, EASEMENTS, CUSTOM AND IMPLIED DEDICATION,
A. N. Littman.
Natural Resource Lawyer, Vol. 10, No. 2, p 279-296 (1977).

Descriptors: *Tidal waters, *Easements, *Conservation, *Public rights, *Recreation, Submerged Lands Act, High water mark, Low water mark, Condemnation, Legal aspects, Water law, Legislation, Water policy, Beaches, Judicial decisions, Soil conservation, State governments, Competing uses, Reasonable use, Public access.

Tidelands are lands covered and uncovered by the ebb and flow of the tide. A widespread effort by the states to increase public use of some and to prevent public or private use of other tidelands has necessitated renewed interpretation and application of the doctrines of public easements, customs, and implied dedication. The leading case in this area is Shively v. Bowlby. In this case, the Supreme Court ruled that the states had the right to sell tidelands subject only to the paramount right of navigation inherent in the public. However, the doctrine of public trust easements, that a grantee of tidelands owns the soil subject to public uses of navigation and commerce, and to the right of the state to enter upon and possess for the preservation and advancement of the public uses, has not been uniformly interpreted by the states. The doctrine of custom and implied dedication, whereby, the right to use a coastal area for recreational purposes not inconsistent with other customs or laws held by the public, has also been subject to diverse interpretations. The article discusses these interpretations in light of various judicial decisions. (Curtis-Florida)
W78-09731

CONTROL OF OIL TRANSPORT IN THE COASTAL ZONE: A LOOK AT PUGET SOUND,
Environmental Protection Agency, Seattle, WA. Region X.
For primary bibliographic entry see Field 5G.
W78-09732

THE EVOLUTION AND IMPLEMENTATION OF EPA'S REGULATORY PROGRAM TO CONTROL THE DISCHARGE OF TOXIC POLLUTANTS TO THE NATION'S WATERS,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 5G.
W78-09733

MINERAL RIGHTS-CONVEYANCES AND LEASES IN MISSOURI,
For primary bibliographic entry see Field 5G.
W78-09734

WATER RESOURCES INVESTIGATIONS IN FLORIDA 1977-78.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 9D.
W78-09745

NEBRASKA'S GROUND WATER MANAGEMENT ACT,
Nebraska Univ., Lincoln. Dept. of Agricultural Engineering.
D. D. Axthelm.
Paper No. 77-2564 presented at the 1977 Winter Meeting of the American Society of Agricultural Engineers, December 13-16, 1977, Chicago, Illinois, 5 p, 4 ref.

Descriptors: *Nebraska, Groundwater, *Groundwater resources, Law enforcement, *Legislation, Water law, Regulations.

The Ground Water Management Act in Nebraska is becoming operational. It is being put into effect in a deliberate and orderly manner by the Natural Resources Districts of Nebraska as dictated by state statute. (Skogerboe-Colorado State)
W78-09763

6F. Nonstructural Alternatives

INTEGRATING ECOLOGICAL AND SOCIAL CONSIDERATIONS INTO URBAN FLOOD CONTROL PROGRAMS,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 6G.
W78-09460

FLOOD PLAIN MANAGEMENT, FOR OREGON CITIES AND COUNTIES.
Oregon Univ., Eugene. Bureau of Governmental Research and Service.
School of Community Service and Public Affairs, Planning Bulletin Number 10, Revised January, 1978. 41 p, 2 fig. $3.50.

Descriptors: *Flood plain zoning, *Land management, *Local governments, *Oregon, Flood plains, Flood plain insurance, Floods, Land tenure, Zoning, Permits, Management, Administrative agencies, Land development, Public health, Cities, Flood protection, Flood damage.

Land adjacent to inland and ocean waters generally has a special value because of the unique characteristics caused by the water. Some of this land has only limited use due to the possibility of flooding. This must be taken into account when installing improvements, although almost all flood-prone land can be utilized for some purpose. The prohibition of land uses that are especially vulnerable to damage, however, is good public policy. Private landowners cannot by themselves accomplish flood plain management. Governmental involvement is necessary. For example, most property owners will not have personal insight into flood conditions. Information about flood magnitude and flood frequency can be made available by government agencies. The local governmental entity responsible for issuing building permits and approving subdivisions should include hazard evaluation as part of its development review process. Because land development and flood issues are closely related, zoning ordinances should include special regulation of development in a flood plain. Local governments are in the best position to prevent flood damage because of their role in administering land development regulations. However, they will often need technical assistance. (Spiegel-Florida)
W78-09725

6G. Ecologic Impact Of Water Development

INTEGRATING ECOLOGICAL AND SOCIAL CONSIDERATIONS INTO URBAN FLOOD CONTROL PROGRAMS,
Utah Water Research Lab., Logan.
L. D. James, A. C. Benke, and H. L. Ragsdale.
Water Resource Research, Vol. 14, No. 2, p 177-184, April 1978. 3 fig, 4 tab, 15 ref. OWRT B-082-GA(3)

Descriptors: *Flood control, Programs, *Urban sociology, *Methodology, *Alternative planning, *Ecology, Environmental effects, Social aspects, Watersheds(Basins), Data collections, Decision making, Public participation, Hydrologic aspects, Engineering, Economics, Evaluation, Optimum development plans.

A well-planned flood control program requires integration of diverse sets of information to develop alternative remedial measures for public discussion and selection. Although procedures for the required hydrologic studies, engineering designs, and economic analyses are readily available, procedures for assessing effects on the natural environment and on social aspects are still being developed. This paper illustrates one approach to integrating all this information in comparing alternatives, using the Proctor Creek watershed in Atlanta, Georgia as an example. The illustration begins with a program such as might be formulated by available planning methodology from hydrologic, economic, and engineering data. The illustration continues with suggestions on how to collect meaningful social suitability data from a questionnaire designed to document public perceptions and preferences, ecological data from natural areas in the floodplain, and data relating the effects of the floodplain land use to the well-being of the community. A procedure for integrating these considerations with the established analyses into alternatives presented for public discussion and decision making is then illustrated. Suggestions are also made on how the selected flood control program can be most successfully implemented. (Bell-Cornell)
W78-09460

LAKE ERIE INTERNATIONAL JETPORT MODEL FEASIBILITY INVESTIGATION; REPORT 10, NONTECHNICAL SUMMARY OF PROJECT,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
D. C. Raney, D. L. Durham, and R. W. Whalin.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A050 749, Price codes: A04 in paper copy, A01 in microfiche. Technical Report H-74-6, January 1978 (Report 10 of a series). 55 p, 17 fig, 13 ref.

Descriptors: *Airports, *Mathematical models, *Hydraulic models, *Feasibility studies, *Lake Erie, Jetports.

A nontechnical summary of the Waterways Experiment Station's (WES) efforts in a model feasibility investigation of a proposed jetport located in Lake Erie offshore Cleveland, Ohio, is presented in this report. This report is intended to present the basic concepts, procedures and results of the WES model feasibility study without technical details. The following items are some of those presented in a format suitable for the nonscientist: (1) scope and objectives of WES study; (2) factors involved in hydrodynamic modeling; (3) lake characteristics and other information required as input for the models; (4) methods for obtaining unavailable data; (5) numerical and physical model evaluation, selection and preliminary design procedures; (6) information obtained from the models; and (7) current status of WES modeling efforts. Detailed technical data and results from WES study were published by WES in a series of 12 reports. (WES)
W78-09467

AN ASSESSMENT OF PROBLEMS ASSOCIATED WITH EVALUATING THE PHYSICAL, CHEMICAL AND BIOLOGICAL IMPACTS OF DISCHARGING FILL MATERIAL,
Oklahoma Univ., Normal. School of Civil Engineering and Environmental Science.
For primary bibliographic entry see Field 5E.
W78-09472

INTEGRATED RESIDUALS MANAGEMENT: A REGIONAL ENVIRONMENTAL QUALITY MANAGEMENT MODEL,
Resources for the Future, Inc., Washington, DC.
For primary bibliographic entry see Field 6A.
W78-09516

ENVIRONMENTAL ASSESSMENT--MANAGEMENT SYSTEM FOR LOCAL DEVELOPMENTAL PROJECT: CASES IN JAPAN,
Nagoya Univ. (Japan). Inst. of Earth Sciences.
For primary bibliographic entry see Field 6A.
W78-09517

COOLING TOWER ENVIRONMENT--1978 (WITH SUPPLEMENT).
Maryland Univ., College Park. Water Resources Research Center.
For primary bibliographic entry see Field 5A.
W78-09570

FOOD-CHAIN RELATIONSHIPS IN SUBTIDAL SILTY SAND MARINE SEDIMENTS AND THE ROLE OF MEIOFAUNA IN STIMULATING BACTERIAL PRODUCTIVITY,
Institut fur Meeresforschung, Bremerhaven (West Germany).
S. A. Gerlach.
Oecologia, Vol. 33, 1978, p 55-69, 3 tab, 77 ref.

Descriptors: *Ecology, Ecosystems, Biological communities, *Productivity, *Food chains, *Bacteria, *Sediments, Sands, Silts, *Marine microorganisms, Benthos, *Biomass.

With the use of bibliographic data, the biomass correlations for the subsurface layer of a hypothetical 30 m deep silty sand station are constructed. Meiofauna and Foraminifera contribute 30 and 12% to the living biomass in the sediment and to the food of deposit-feeding macrofauna. Productivity of bacteria is low, leading to the conclusion that sediment bacteria, generally, do not live under good environmental conditions. Meiofaunal animals induce a bacterial productivity which would not exist without them by their activities and by excreting metabolic end products. This specialized interaction between benthic animals and bacteria could be highly important in the benthic ecosystem. (Chilton-ORNL)
W78-09578

SEASONAL AND VERTICAL DISTRIBUTION AND GROWTH OF JUVENILE AND ADULT CAPELIN (MALLOTUS VILLOSUS) IN THE ST. LAWRENCE ESTUARY AND WESTERN GULF OF ST. LAWRENCE,
McGill Univ., Montreal (Quebec). Dept. of Biology.
R. F. J. Bailey, K. W. Able, and W. C. Leggett.
Journal of the Fisheries Research Board of Canada, Vol 34, 1977, p 2030-2040, 8 fig, 3 tab, 35 ref. Nat'l. Res. Council of Canada A6513.

Descriptors: *Ecology, *Distribution, *Seasonal, Growth rates, Fish, Juvenile growth stage, Mature growth stage, *St. Lawrence Estuary, *Gulf of St. Lawrence.

The ecology of juvenile and adult capelin in the study area was investigated in response to a concern over a recent increase in exploitation of the species. The western Gulf served as a nursery for larval and juvenile capelin in summer and early fall. In November, juvenile and adult capelin concentrated in dense schools and moved into the lower estuary to spawning areas. Postspawning mortality was high. Juvenile capelin were supported by zooplankton near the mouth of the Saguenay River throughout the year and in turn provided food for beluga whales in the area during the summer. Growth rates of capelin in the study area were similar to those of populations spawning in southern Newfoundland and on the Grand Banks but were significantly faster than those reported for northern Newfoundland and Labrador. (Chilton-ORNL)
W78-09597

ARID AND SEMI-ARID LANDS: PROBLEMS AND PROSPECTS,
Cairo Univ. Giza (Egypt).

M. Kassas.
Agro-Ecosystems, Vol. 3, No. 3, p 185-204, June, 1977. 23 ref.

Descriptors: *Deserts, *Arid lands, *Climates, Agriculture, *Semiarid climates, Population, *Surveys, Desertification.

A survey of the world's deserts and processes of desertification identifies those that are strictly due to physical factors and those that are anthropogenic. Areas of potential useful study are identified: Improved climate, climatic research and monitoring, improvement of arid zone cultivars, improved techniques of decision-making about land use. Warnings are given to the dangers of overintensification of agricultural systems and of increasing population density in arid zones. Research areas suitable for international cooperation are outlined. (Skogerboe-Colorado State)
W78-09655

AN INTRODUCTION TO FOUR OVERVIEWS: ARID AND SEMI-ARID LANDS; SOIL LOSS; TROPICAL FORESTS AND WOODLANDS; WATER QUALITY,
United Nations Environment Program, New York.
M. K. Tolba.
Agro-Ecosystems, Vol. 3, No. 3, p 183-184, June 1977.

Descriptors: Erosion, *Water quality, Watershed(Basins), Climates, *Arid lands, Arid climates, *Semiarid climates, Soils.

One of the major tasks assigned by the United Nations General Assembly to the Governing Council of the United Nations Environment Program, in the aftermath of recommendations made at the United Nations Conference on the Human Environment convened at Stockholm in 1972, was to 'keep under review the world environmental situation in order to ensure that emerging environmental problems of wide international significance receive appropriate and adequate consideration.' To assist in carrying out this task, the Executive Director was requested by the Governing Council of UNEP, at its second session in 1974, to prepare each year reviews of one or more of the priority subjet areas of the Environment Program, in addition to preparing an annual State of the Environment Report which summarizes the most important and the major emerging issues that affected the environment during the preceding year. (Skogerboe-Colorado State)
W78-09657

POWER PLANT SITING ON WISCONSIN'S COASTS: A CASE STUDY OF DISPLACEABLE USE,
Wisconsin Univ.-Madison. Center for Resource Policy Studies and Programs.
C. B. Bishop, and D. L. Vogel.
Coastal Zone Management Journal, Vol. 3, No. 4, p. 363-381 (1977).

Descriptors: *Wisconsin, *Power plants, *Sites, *Comparative costs, *Shore protection, Electric power plants, Great Lakes region, Planning, Future planning(Projected), Locating, Economic efficiency, Estimated costs, Regional development, Coastal structures, Coasts, Water law, Electric power costs.

If predictions are accurate, Wisconsin will have several new power plants by the year 2000. As many as three large baseload plants and two to five intermediate-load coal-fired plants will be considered. Whether lakeshore sites or inland sites are used will depend upon construction costs, fuel costs, and costs for required water quality equipment. The environmental issue raised by 'once-through' cooling at lakeshore sites may tip the scales in favor of inland sites. Damages to the water and its inhabitants due to the 'once-through' cooling source are not uncommon. Millions of fish have been killed in a single day. However, inland sites may also have adverse impacts on the environment. For instance, larger amounts of land would be necessary. Lakeshore and inland sitings are not the only choices. Alternatives dealing with coastal displacement should be explored. Unfortunately, very few studies dealing with the economic feasibility of this type of proposal have been conducted. Both the Wisconsin Department of Natural Resources and Wisconsin Public Services Commission are presently studying all alternatives to the problem. (Spiegel-Florida)
W78-09701

WHO WILL OWN THE OCEANS,
For primary bibliographic entry see Field 6E.
W78-09706

A RESEARCH STRATEGY FOR SOCIAL ASSESSMENT OF LAKE RESTORATION PROGRAMS,
Oregon State Univ., Corvallis. Dept. of Anthropology.
For primary bibliographic entry see Field 5G.
W78-09710

COLORADO RIVER DESALINIZATION, WILD DUCK STUDY,
Colorado State Univ., Fort Collins, Dept. of Physiology and Biophysics.
For primary bibliographic entry see Field 5G.
W78-09799

7. RESOURCES DATA

7A. Network Design

COLLECTION, STORAGE, RETRIEVAL, AND PUBLICATION OF WATER-RESOURCES DATA.
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09323

7B. Data Acquisition

EVAPORATION AND RADIATION MEASUREMENTS AT SALTON SEA, CALIFORNIA,
Geological Survey, Bay St. Louis, MS. Water Resources Div.
For primary bibliographic entry see Field 2D.
W78-09322

STANDARDIZATION OF HYDROLOGIC MEASUREMENTS,
Geological Survey, Reston, VA. Water Resources Div.
G. F. Smoot.
In: Collection, Storage, Retrieval, and Publication of Water-Resources Data: Geological Survey Circular 756, p 1-7, 1978. 2 fig, 4 ref.

Descriptors: *Hydrologic data, *Data collections, *Instrumentation, *Standards, Evaluation, Office of Water Data Coordination, American Society for Testing and Materials, International Organization for Standardization, World Meteorological Organization, International Electro-Technical Commission, International Current Meter Group, International Association of Scientific Hydrology.

The need for standardization of the methods and instruments used in measuring hydrologic data is discussed and the process by which standards are derived is described. The standardization efforts in the United States are reported including the activities of the Federal Interagency Work Group for the Designation of Standards for Water Data Acquisition and the activities within the American Society for Testing and Materials. On the international front, work being done by the various Technical Committees of the International Organization for Standardization, the World Meteorological Organization, and other international groups is described. Recognition of some duplication of effort is noted. The recommendation is made that better liaison and cooperation be established between the various standards writing organizations. (See also W78-09323) (Woodard-USGS)
W78-09324

USE OF EARTH SATELLITES FOR AUTOMATION OF HYDROLOGIC DATA COLLECTION,
Geological Survey, Reston, VA. Water Resources Div.
R. W. Paulson.
In: Collection, Storage, Retrieval, and Publication of Water-Resources Data: Geological Survey Circular 756, p 8-14, 1978. 2 fig, 1 tab.

Descriptors: *Hydrologic data, *Data collections, *Remote sensing, *Telemetry, *Remote control, Analytical techniques, Planning, Network design, Measurement, Automation, *Battery-operated radios.

The U.S. Geological Survey is evaluating a recently developed earth-satellite technology that is expected to provide a cost-effective technique for the automatic collection of data from hydrologic stations. The technology, which is referred to as satellite Data Collection Systems (DCS), privides an opportunity to collect data from inexpensive battery-operated radios located at literally tens of thousands of hydrologic stations distributed over national or continental areas. The U.S. Geological Survey is evaluating the DCS on three series of earth satellites to forecast the costs and benefits of using earth satellite technology for a national operational system for the automatic collection of hydrologic data. (See also W78-09323) (Woodard-USGS)
W78-09325

OPERATIONAL HYDROMETEOROLOGICAL DATA COLLECTION SYSTEM FOR THE COLUMBIA RIVER,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09326

PROGRAM THE MANNING EQUATION,
Camp, Dresser, and McKee Inc., Boston, MA.
E. C. Hart.
Water and Wastes Engineering, Vol. 15, No. 5, p 72, 74, 76, May, 1978. 2 tab.

Descriptors: *Mannings equation, *Programs, *Instrumentation, *Flow rates, *Pipelines, Analytical techniques, Sewers, Sewerage, Channel flow, Discharge measurement, Mathematical studies, Equipment, Waste water treatment, Municipal wastes.

The Texas Instruments SR-52 calculator can be programmed with the Mannings Equation for rapid calculation of pipeline discharge, area, wetted perimeter, and velocity. The SR-52 calculator, which costs less than $200, is programmed on the Algebraic Operating System, permitting direct entry of the program from left to right, with the addition of parentheses as written. The calculator has an established hierarchy in which functions, powers and roots, multiplication and division, and addition and subtraction are solved sequentially. Two programs are available for solving the Mannings Equation when the depth of flow in the pipe is in the range of 0.5-1.0 and 0-0.5. The SR-52 retains all input parameters, which may also be easily changed, and is attachable to the PC-100 for printout copies of solved programs. (Lisk-FIRL)
W78-09376

A SYSTEM THAT MEASURES BLOWING SNOW,
Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO.
For primary bibliographic entry see Field 2C.
W78-09527

SYMPOSIUM ON APPLIED GLACIOLOGY.
International Glaciological Society, Cambridge (England).
For primary bibliographic entry see Field 2C.
W78-09603

MEASURING THE UNIAXIAL COMPRESSIVE STRENGTH OF ICE,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2C.
W78-09615

FRICTION OF A STEEL BALL ON A SINGLE CRYSTAL OF ICE,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
For primary bibliographic entry see Field 2C.
W78-09616

CONCENTRATED LOADS ON A FLOATING ICE SHEET,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2C.
W78-09617

FLEXURAL STRENGTH OF ICE ON TEMPERATE LAKES,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2C.
W78-09618

INDENTATION TESTS TO INVESTIGATE ICE PRESSURES ON VERTICAL PIERS,
Imperial Oil Ltd., Calgary (Alberta).
For primary bibliographic entry see Field 2C.
W78-09622

CONTINUOUS MONITORING OF METAMORPHIC CHANGES OF INTERNAL SNOW STRUCTURE AS A TOOL IN AVALANCHE STUDIES,
Colorado Univ., Boulder. Inst. of Arctic and Alpine Research.
For primary bibliographic entry see Field 2C.
W78-09624

GRADIENT METAMORPHISM, ZONAL WEAKENING OF THE SNOWPACK AND AVALANCHE INITIATION,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 2C.
W78-09625

PRELIMINARY OBSERVATIONS OF ACOUSTIC EMISSIONS PRECEDING AVALANCHES,
Rocky Mountain Forest and Range Experiment Station, Fort Collins.
For primary bibliographic entry see Field 2C.
W78-09631

STUDIES OF THE MOVEMENT OF COASTAL SEA ICE NEAR PRUDHOE BAY, ALASKA, U.S.A.,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2C.
W78-09641

THE FLEXURAL MOTIONS OF A FLOATING ICE SHEET INDUCED BY MOVING VEHICLES,
Saskatchewan Research Council, Saskatoon.
For primary bibliographic entry see Field 2C.
W78-09643

MARINE DYNAMICS AND ITS EFFECTS ON CURRENT MEASURING TRANSDUCERS,
National Oceanic and Atmospheric Administration, Sterling, VA.
T. Mero, G. Appell, and R. S. McQuivey.
In: National Bureau of Standards Special Publication 484, Proceedings of the Symposium on Flow in Open Channels and Closed Conduits, Gaithersburg, Maryland, February 23-25, 1977. p 109-121, October 1977, 3 fig, 3 tab, 3 ref.

Descriptors: Velocity, *Flow measurement, *Currents(Water), Turbulence, *Turbulent flow, Estuaries, Coasts.

A growing interest in measuring current velocities in coastal zne and estuaries prompted the creation of a Dynamic Analysis Program. The dynamics of near-shore current flows are more severe than that of the deep ocean. Therefore, it is important to qualify the performance of current measuring transducers in a dynamic environment. A study was contracted to determine what scale and intensities of turbulence exist in the near-shore environment. The major effort of the study is concerned with turbulence from 1 to 20 Hz and scales up to 30 cm. Tests are being conducted to determine the response characteristics of several current measuring transducers including both rotor and electromagnetic instruments. These tests include grid-produced turbulence measurements as well as simulated mooring-line dynamics' tests. Measurements have revealed several transducers that have 10 to 20% sensitivity increases when turbulence intensities of 6 to 12% are present. Turbulence that exists in the marine environment is described along with dynamic response characteristics of several current measuring transducers. (Skogerboe-Colorado State)
W78-09651

A SELF-PROPELLED HIGH-CLEARANCE SOIL CORING MACHINE,
Texas A and M Univ. Lubbock. Agricultural Research and Extension Center.
W. Bausch, A. B. Onken, C. W. Wendt, and O. C. Wilke.
Agronomy Journal, Vol. 69, No. 1, p 122-124, January-February 1977. 4 fig, 1 tab, 6 ref.

Descriptors: *Sampling, Crop production, Soil investigations, Soils, Soil tests, Soil profiles, Soil properties, *Soil coring machines.

Mechanical soil sampling equipment currently available is suitable for sampling prior to crop establishment or in low growing crops but cannot be used without plant damage in some tall crops. A self-propelled high-clearance soil coring machine was designed and constructed to obtain soil samples in a tall standing crop at a range of lateral as well as vertical distances. The sampler is hydraulically operated and has vertical pressure and rotary drilling capabilities. This equipment has a lateral travel span of 152 cm and the capability of coring to a depth of 9 m with the mast in any lateral position on the track. Two operators can use the sampler without difficulty; however, three operators are desirable if a large number of samples are to be taken. As many as eighty 30-cm increment soil samples have been taken per hour when sampling a moist sandy soil to a depth of 2 m. (Skogerboe-Colorado State)
W78-09654

SCHEDULING AND MONITORING IRRIGATION WITH INFRA-RED PHOTOGRAPHY,
Crop Protection, Inc., Umatilla, OR.
For primary bibliographic entry see Field 3F.
W78-09680

TECHNIQUE FOR ESTIMATING MAGNITUDE AND FREQUENCY OF FLOODS IN VIRGINIA,
Geological Survey, Richmond, VA. Water Resources Div.
For primary bibliographic entry see Field 2E.
W78-09737

CALIBRATION OF A MATHEMATICAL MODEL OF THE ANTELOPE VALLEY GROUND-WATER BASIN, CALIFORNIA,
Geological Survey, Laguna Niguel, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W78-09741

7C. Evaluation, Processing and Publication

HYDROLOGIC DATA OF THE COASTAL DRAINAGE BASINS OF SOUTHEASTERN MASSACHUSETTS, PLYMOUTH TO WEWEANTIC RIVER, WAREHAM,
Geological Survey, Boston, MA. Water Resources Div.
J. R. Williams, G. D. Tasker, and R. E. Willey.
Massachusetts Hydrologic-Data Report No. 18, 1977. 31 p, 1 fig, 1 plate, 10 tab, 35 ref. Open File Report 77-186.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Water quality, *Massachusetts, Hydrologic data, River basins, Streamflow, Flow rates, Aquifers, Drillers logs, Stratigraphy, Water wells, Water yield, Available water, Water supply, Water analysis, Chemical analysis, *Southeastern Massachusetts.

The principal basins in this study in southeastern Massachusetts are those of Town Brook, Eel River, and Beaverdam Brook, all draining to Cape Cod Bay; Herring Brook draining to the Cape Cod Canal; and Red Brook, Agawam River, Wankinco River, and Weweantic River, all draining to Buzzards Bay. This report presents, in tabular form, selected records of wells, test wells, borings, and important springs; measurements of stream discharge, specific conductance, and temperature at partial-record stations; chemical analyses of ground water and surface water; and a summary of municipal water sources and additional sources available. The data were collected from 1969 to 1971 in cooperation with the Massachusetts Water Resources Commission. (Woodard-USGS)
W78-09304

HYDROLOGIC DATA OF THE CHARLES RIVER BASIN, MASSACHUSETTS,
Geological Survey, Boston, MA. Water Resources Div.
E. H. Walker, W. W. Caswell, and S. W. Wandle, Jr.
Massachusetts Hydrologic-Data Report No. 19, 1977. 53 p, 1 fig, 1 plate, 10 tab, 24 ref.

Descriptors: *Hydrologic data, *Surface waters, *Groundwater, *Water quality, *Basic data collections, Streamflow, Flow rates, Aquifers, Water wells, Water yield, Well data, Water levels, Water analysis, Chemical analysis, Maps, Sites, Measurement, Sampling, Massachusetts, *Charles River basin(Mass).

The Charles River basin drains about 300 square miles in eastern and southeastern Massachusetts within Middlesex, Norfolk, Suffolk, and Worcester counties, into Boston Harbor. This report contains hydrologic data for the area above Waltham and includes all, or parts of, the cities or towns of Ashland, Bellingham, Boston, Brookline, Dedham, Dover, Foxboro, Franklin, Holliston, Hopedale, Hopkinton, Lexington, Lincoln, Med-

field, Medway, Mendon, Sherborn, Waltham, Walpole, Wayland, Wellesley, Weston, Westwood, and Wrentham. Data include information on wells, borings, water table, streamflow, and water quality. (Woodard-USGS)
W78-09305

A GUIDE TO OBTAINING INFORMATION FROM THE USGS 1978,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 10C.
W78-09309

WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1977--VOLUME 2. LONG ISLAND.
Geological Survey, Albany, NY. Water Resources Div.
Water-Data Report NY-77-2, March 1978. 144 p, 8 fig, 1 tab.

Descriptors: *New York, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Long Island.

Water resources data for the 1977 water year for New York consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; water quality of precipitation; and water levels and water quality of ground water. This report (Volume 2) contains discharge records for 15 gaging stations; water quality for 13 gaging stations, 4 partial-record stations, 78 wells, and 2 precipitation stations; and water levels for 117 observation wells. Also included are 93 low-flow partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the U.S. Geological Survey in cooperation with State, Federal, and other agencies in New York. (Woodard-USGS)
W78-09311

WATER RESOURCES DATA FOR ILLINOIS, WATER YEAR 1977.
Geological Survey, Champaign, IL. Water Resources Div.
Water-Data Report IL-77-1, March 1978. 436 p, 4 fig.

Descriptors: *Illinois, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1977 water year for Illinois consist of records of stage, discharge, and water quality of streams; stage and contents of lakes and reservoirs; and water levels and water quality of ground water. This report contains discharge records for 163 gaging stations; stage only records for 5 gaging stations; stage and contents for 3 lakes and reservoirs; stage only records for 5 lake stations; water quality for 46 gaging stations, 14 partial-record stations, 8 miscellaneous stations, and 35 wells; and water levels for 3 observation wells. Also included are data for 171 crest-stage partial-record stations and 60 flood-profile stations. Additional water data were collected at various sites, not involved in the systematic data collection program and are published as miscellaneous measurements. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Illinois. (Woodard-USGS)
W78-09312

WATER RESOURCES DATA FOR NEW YORK, WATER YEAR 1977--VOLUME 1. NEW YORK EXCLUDING LONG ISLAND.
Geological Survey, Albany, NY. Water Resources Div.
Water-Data Report NY-77-1, May 1978. 566 p, 8 fig, 1 tab.

Descriptors: *New York, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1977 water year for New York consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes; stage and contents of reservoirs; water quality of precipitation; and water levels and water quality of ground water. This report (Volume 1), which excludes Long Island, contains discharge records for 192 gaging stations; stage only records for 32 gaging stations (including 30 lakes and reservoir stations and 2 other river stations); stage and contents for 20 other lakes and reservoirs; water quality for 67 gaging stations (includes 4 lake stations), 17 partial-record stations, and 8 precipitation stations; and water levels for 40 observation wells. Also included are 140 crest-stage partial-record stations and 32 low-flow partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the U.S. Geological Survey in cooperation with State, Federal, and other agencies in New York. (Woodard-USGS)
W78-09313

WATER-RESOURCES INVESTIGATIONS IN NORTH CAROLINA, 1977.
Geological Survey, Raleigh, NC. Water Resources Div.
Water-Resources Investigations in North Carolina Folder, 1978. 1 sheet.

Descriptors: *Water resources, *Investigations, *Inter-agency cooperation, *North Carolina, Surveys, Planning, Hydrologic data, Basic data collections, Streamflow, Groundwater, Water quality, On-site investigations, Dissolved solids, Water level fluctuations, Bibliographies, Networks, Maps, *U.S. Geological Survey, *Cooperative water-studies program.

Water-resources studies and investigations in North Carolina in which the U.S. Geological Survey participates are summarized. A bibliography of selected material concerning these investigations is included. The investigations include collections of basic information through a hydrologic data network, areal hydrologic or interpretative studies, and research projects. The hydrologic data network consists of primary, secondary, and water management streamflow stations; groundwater observation wells; and water quality observation sites. Small State maps show flood-prone areas, mean annual precipitation, average annual rainfall, minimum flows of unregulated small streams, principal sources of groundwater, and dissolved solids in groundwater and surface waters. A larger map shows hydrologic-data stations and hydrologic investigations in North Carolina as of January 1977. (Woodard-USGS)
W78-09315

IDENTIFICATION CODES FOR ORGANIZATIONS LISTED IN COMPUTERIZED DATA SYSTEMS OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey, Reston, VA. Water Resources Div.
M. D. Edwards, and M. O. Drilleau.
Open-file report 78-398, 1978. 66 p, 1 fig, 2 ref.

Descriptors: *Information retrieval, *Data storage and retrieval, *Information exchange, *Publications, *Water resources, Indexing, National Water Data Exchange(NAWDEX), National Water Data Storage and Retrieval System(WATSTORE), National Cartographic Information Center(NCIC), Office of Water Data Coordination(OWDC), *Organization identification codes, *Computerized data systems, *U.S. Geological Survey.

This report contains codes for the identification of public and private organizations listed in computerized data systems. These codes are used by the U.S. Geological Survey's National Water Data Exchange (NAWDEX), National Water Data Storage and Retrieval System (WATSTORE), National Cartographic Information Center (NCIC), and Office of Water Data Coordination (OWDC). The format structure of the codes is discussed and instructions are given for requesting new codes. (Woodard-USGS)
W78-09317

DEFINITIONS OF COMPONENTS OF THE WATER DATA SOURCES DIRECTORY MAINTAINED BY THE NATIONAL WATER DATA EXCHANGE,
CACI Inc., Reston, VA; and Geological Survey, Reston, VA. Water Resources Div.
W. A. Knecht, and M. D. Edwards.
Open-file report 77-775, 1978. 99 p, 3 fig, 8 ref.

Descriptors: *Information retrieval, *Data storage and retrieval, *Organizations, *Water sources, *Publications, Documentation, Surface waters, Groundwater, Water quality, *National Water Data Exchange(NAWDEX), *Dictionary use information, *Data definitions, *System 2000, *Data base management systems, Data dissemination.

This report contains a definition and description of each component of the Water Data Souces Directory data base maintained by the National Water Data Exchange (NAWDEX). It is intended, primarily, to assist those persons using the Water Data Sources Directory in understanding information obtained from the data base. The Water Data Sources Directory is a computerized data base maintained and operated using the System 2000 data base management system. It contains information about organizations that collect, store, and disseminate water data. (Woodard-USGS)
W78-09319

CHEMICAL AND PHYSICAL QUALITY OF SELECTED PUBLIC WATER SUPPLIES IN FLORIDA, AUGUST-SEPTEMBER 1976,
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-09320

COLLECTION, STORAGE, RETRIEVAL, AND PUBLICATION OF WATER-RESOURCES DATA.
Geological Survey, Reston, VA. Water Resources Div.
Available from Branch of Distribution, USGS 1200 S. Eads St., Arlington, VA 22202. Circular 756, 1978. 39 p, 15 fig, 1 tab, 23 ref.

Descriptors: *Hydrologic data, *Data collections, *Data storage and retrieval, *Publications, *Information retrieval, Information exchange, Instrumentation, Standards, Remote sensing, Telemetry, Remote control, Methodology, Measurement, Planning, Network design, Costs, Computers, *U.S. Geological Survey, *Realtime data-collection system, National Water Data Storage and Retrieval System(WATSTORE).

This publication represents a series of papers devoted to the subject of collection, storage, retrieval, and publication of hydrologic data. The

papers were presented by members of the U.S. Geological Survey at the International Seminar on Organization and Operation of Hydrologic Services, Ottawa, Canada, July 15-16, 1976, sponsored by the World Meteorological Organization. The first paper, 'Standardization of Hydrologic Measurements,' by George F. Smoot discusses the need for standardization of the methods and instruments used in measuring hydrologic data. The second paper, 'Use of Earth Satellites for Automation of Hydrologic Data Collection,' by Richard W. Paulson discusses the use of inexpensive battery-operated radios to transmit realtime hydrologic data to earth satellites and back to ground receiving stations for computer processing. The third paper, 'Operation Hydrometeorological Data-Collection System for the Columbia River,' by Nicholas A. Kallio discusses the operation of a complex water-management system for a large river basin utilizing the latest automatic telemetry and processing devices. The fourth paper, 'Storage and Retrieval of Water-Resources Data,' by Charles R. Showen discusses the U.S. Geological Survey's National Water Data Storage and Retrieval System (WATSTORE) and its use in processing water resources data. The final paper, 'Publication of Water Resources Data,' by S. M. Lang and C. B. Ham discusses the requirement for publication of water-resources data to meet the needs of a widespread audience and for archival purposes. (See W78-09324 thru W78-09328) (Woodard-USGS)
W78-09323

STANDARDIZATION OF HYDROLOGIC MEASUREMENTS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W78-09324

USE OF EARTH SATELLITES FOR AUTOMATION OF HYDROLOGIC DATA COLLECTION,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7B.
W78-09325

OPERATIONAL HYDROMETEOROLOGICAL DATA COLLECTION SYSTEM FOR THE COLUMBIA RIVER,
Geological Survey, Reston, VA. Water Resources Div.
N. A. Kallio.
In: Collection, Storage, Retrieval, and Publication of Water-Resources Data: Geological Survey Circular 756, p 15-19, 1978. 1 ref.

Descriptors: *Telemetry, *Data collections, *Hydrologic data, *Columbia River, Planning, Instrumentation, Network design, Methodology, Costs, *Realtime data-collection system, *Hydrometeorological data.

The Columbia River is a valuable source of energy and water supply to the Northwest region of the United States and the Southwest region of Canada. Operation of its complex water-management system requires reliable and timely information on the amount of water received by, flowing through, and stored in all parts of the basin. To provide this information, an interagency hydrometeorological data-collection system is being developed, utilizing latest telemetry and processing devices. The experience gained in developing this system may be helpful to planners of other similar systems. Pertinent considerations are: (1) A telemetry system should be chosen with care so as to avoid early obsolescence and costly maintenance. Satellite and meteor-burst systems seem to have greatest potential. (2) Data verification is very important in a realtime system. (3) The cost of operating a realtime system is dependent on data-accuracy requirements, but generally will be more than operation for collection of historical records. (See also W78-09323) (Woodard-USGS)
W78-09326

STORAGE AND RETRIEVAL OF WATER-RESOURCES DATA,
Geological Survey, Reston, VA. Water Resources Div.
C. R. Showen.
In: Collection, Storage, Retrieval, and Publication of Water-Resources Data: Geological Survey Circular 756, p 20-25, 1978. 2 fig, 11 ref.

Descriptors: *Data storage and retrieval, *Publications, *Hydrologic data, *Computers, Information retrieval, Information exchange, *U.S. Geological Survey, *National Water Data Storage and Retrieval System(WATSTORE).

The U.S. Geological Survey investigates the occurrence, quantity, quality, distribution, and movement of the surface and underground water that comprise the water resources of the United States. It is the principal Federal water-data agency and, as such, collects and disseminates about 70 percent of the water data currently being used by numerous State, local, private, and other Federal agencies to develop and manage the Nation's water resources. As part of the Geological Survey's program of releasing water data to the public, a large-scale computerized system has been developed for the processing, storage, and retrieval of water data collected through its activities. The U.S. Geological Survey's National Water Data Storage and Retrieval System (WATSTORE) was established in November 1971 to modernize water-data processing procedures and techniques and to provide for more effective and efficient management of data-releasing activities. The system is operated and maintained on the central computer facilities of the Survey at its National Center in Reston, Va. (See also W78-09323) (Woodard-USGS)
W78-09327

PUBLICATION OF WATER-RESOURCES DATA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 10C.
W78-09328

HYDROLOGICAL ASPECTS OF THE DROUGHT EVENT IN NIGERIA-1972/1973,
Lagos Univ. (Nigeria). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2B.
W78-09333

ANNUAL AMPLITUDE OF PRECIPITATION IN THE USSR,
For primary bibliographic entry see Field 2B.
W78-09337

UNBIASED PLOTTING POSITIONS-A REVIEW,
Ireland Office of Public Works, Dublin.
C. Cunnane.
Journal of Hydrology, Vol. 37, No. 3/4, p 205-222, May 1978. 4 fig, 2 tab, 37 ref.

Descriptors: *Graphical analysis, *Graphical methods, *Reviews, *Analytical techniques, Statistical methods, Mathematical studies, Data processing, Hydrologic data, Statistics, Distribution patterns, Unbiased data plotting.

The existing attitude that the criterion for choice of plotting position is arbitrary was rebuked, and it was shown that a worthwhile criterion can be based on desired statistical properties of the plot, rather than on comparison of plotting positions with estimates of probability for individual sample values. These properties are that any quantile estimate made from the plot should be unbiased and should have smallest mean square error among all such estimates. This leads to specification of plotting position, initially in terms of reduced variate rather than probability value. The unbiased plotting position the mean of the ith order statistic in samples from the reduced variate population, which differs from one distribution to another. A good approximation for each distribution is available in the probability domain. These take the general form (i-alpha)/(N + 1-2 alpha) with alpha = 3/8 in the normal case and a = 0.44 in the extreme-value type-1 (EV1) and exponential cases. The Weibull formula, alpha = 0, is correct for the uniform distribution alone and was shown to be biased for other distributions. Hazen's formula alpha = 1/2 shows up much better in terms of bias than many would expect. If a single simple distribution free formula were required, then alpha = 2/5 would be the best compromise. The plotting position postulates which have supported the Weibull formula for many years were examined, and some were seen to be unreasonable in view of statistical facts. (Humphreys-ISWS)
W78-09348

RAINFALL DEPTH-DURATION-FREQUENCY STUDIES FOR SRI LANKA,
Halcrow (William) and Partners, London (England).
For primary bibliographic entry see Field 2B.
W78-09349

TAKE THE PICK AND SHOVEL WORK OUT OF COMPUTATION,
T. H. Hablett.
Water and Wastes Engineering, Vol. 15, No. 4, p 52-54, April, 1978. 3 tab.

Descriptors: *Computer programs, *Mannings equation, *Analytical techniques, *Pipes, *Flow resistance, Fluid friction, Flow rates, Computers, Data processing, Sewerage, Model studies, Waste water disposal, Municipal wastes.

A computer program can adapt Manning's equation to calculate the diameter of gravity pipes when the pipe flow velocity and slope are known. Program 096, readily adaptable to programmable calculators, calculates the diameter and depth of the pipe as a function of water quantity discharged (Q(f)) and the velocity (V(f)) at a given friction. A chart relating diameter and depth to these calculated values is reproduced for a round corrugated-steel pipe having a Manning's coefficient for pipe interior roughness of 0.021. When Program 096 is used in conjunction with the chart, information on a specific gravity main is input in the following order: point number for beginning of gravity flow; gpm; difference between entry and discharge; horizontal length of pipe; slope; and Maning's coefficient. At this point, the nearest value correlating Q(f) to diameter and depth of flow is chosen from the chart and fed to the computer as follows: velocity; Q(f) from the chart; diameter; and water depth. The effectiveness of different pipe diameters can be compared by manual return to a specific stage within the program. (Lisk-FIRL)
W78-09372

AUTOMATIC CONTROL OF A DIFFUSED AIR TREATMENT PLANT,
For primary bibliographic entry see Field 5D.
W78-09397

METHODOLOGY FOR CALIBRATING STORMWATER MODELS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W78-09459

COMPARISON OF NUMERICAL AND PHYSICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2L.
W78-09477

SYSTEMS PROGRAM FOR THE ANALYSIS OF NONURBAN, NONPOINT SOURCE POLLUTANTS IN THE MISSOURI BASIN REGION,
Midwest Research Inst., Kansas City, MO.
For primary bibliographic entry see Field 5B.
W78-09519

SYSTEMS PROGRAMS FOR THE ANALYSIS OF NONURBAN, NONPOINT SOURCE POLLUTANTS IN THE MISSOURI BASIN REGION. SUPPLEMENT,
Midwest Research Inst., Kansas City, MO.
For primary bibliographic entry see Field 5B.
W78-09520

SYNOPTIC RAINFALL DATA ANALYSIS PROGRAM (SYNOP),
Hydroscience, Inc., Westwood, NJ.
For primary bibliographic entry see Field 5B.
W78-09521

CLIMATOLOGICAL DATA FROM THE BERTHOUD PASS AREA OF COLORADO,
Rocky Mountain Forest and Range Experiment Station, Fort Collins, CO.
A. Judson.
Department of Agriculture, Forest Service, General Technical Report RM-42, 94 p, October, 1977. 1 fig, 7 illus, 11 ref, 150 tab.

Descriptors: *Meteorological data, *Colorado, *Mountains, Climates, *Weather data, *Berthoud Pass(Colo), Air temperature, Precipitation(Atmospheric), Snow cover, Depth, Winds, *Rocky Mountain Region.

Monthly, daily, and hourly meteorological data, collected irregularly from 1926 through 1977, are presented in tabular form. Complete year-long data on temperature, precipitation, snow depth, and wind from three mountain sites surrounding Berthoud Pass, Colorado, are analyzed for the period 1963 through 1975. (Witt-IPC)
W78-09526

METROPOLITAN WATER SYSTEMS OPERATION: CONTINUOUS MODELING OF FLOW QUANTITY AND QUALITY IN THE SUPPORTING RIVER BASIN,
Dallas Water Utilities Dept. TX. Operations Analysis Div.
For primary bibliographic entry see Field 5C.
W78-09569

SUSCEPTIBILITY OF COASTAL PLAIN AQUIFERS TO CONTAMINATION, FAIRFAX COUNTY, VIRGINIA, A COMPUTER COMPOSITE MAP,
Geological Survey, Reston, VA. Water Resources Div.
R. H. Johnson, and J. N. Van Driel.
Open-file map 78-265, 1978. 1 sheet, 9 ref.

Descriptors: *Aquifer characteristics, *Subsurface mapping, *Water pollution, *Virginia, *Coastal plains, Groundwater movement, Groundwater recharge, Leaching, Path of pollutants, *Fairfax County, *Potential groundwater pollution areas, Computer-generated composit map, *Computer mapping.

A map is presented that classifies the Coastal Plain of Fairfax County, Virginia according to the susceptibility of the principal sand aquifers to contamination from surface sources. The following classification is used: (1) areas where leachate can readily enter the principal sand aquifers, (2) areas offering great natural protection against migration of leachate into the aquifers, and, (3) areas where the contamination risk is uncertain and onsite investigations are needed. Approximately 20 percent of the area is in the high-risk category. The map is computer generated and was made by combining four source maps depicting those hydrogeologic factors related to movement of contaminants into the aquifers. These factors are (1) lithologic character of the upper 25 feet of sediments, (2) clay thickness above uppermost sand aquifer, (3) hydraulic gradient direction and head difference between water table and artesian head in principal aquifer, and (4) areal occurrence of moderate to high transmissiviry aquifers. The map is designed to be used by planners with little or no earth-science background, however, a technical discussion for hydrologists and geologists is also provided. (Woodard-USGS)
W78-09735

HYDROLOGIC DATA FOR LITTLE ELM CREEK, TRINITY RIVER BASIN, TEXAS, 1976,
Geological Survey, Austin, TX. Water Resources Div.
R. M. Slade, Jr., T. H. Hays, and C. T. Schoultz.
Open-file report 78-100, April 1978. 78 p, 2 fig, 4 tab.

Descriptors: *Rainfall-runoff relationships, *Storm runoff, *Small watersheds, *Soil conservation, *Texas, Control structures, Flood protection, Streamflow, Flow rates, Flood profiles, Peak discharge, Hydrologic data, Water quality, *Little Elm Creek, *Trinity River basin, Floodwalls.

This report contains rainfall, runoff, and storage data collected during the 1976 water year for a 75.5 sq mi area above the stream-gaging station Little Elm Creek near Aubrey, Texas. Floodflows from 35.7 sq mi of the area are regulated by 16 flood-water-retarding structures constructed by the Soil Conservation Service. During the 1976 water year, five storm periods were selected for detailed computations and analyses. Beginning with the 1975 water year, water-quality data is given for Little Elm Creek. Investigations in the Little Elm Creek watershed were terminated on September 30, 1976. (Woodard-USGS)
W78-09736

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1977--VOLUME 2. ST. LAWRENCE RIVER BASIN.
Geological Survey, Columbus, OH. Water Resources Div.
Water-Data Report OH-77-2, May 1978. 212 p, 2 fig.

Descriptors: *Ohio, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *St. Lawrence River basin.

Water resources data for the 1977 water year for Ohio consist of records of stage, discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report in two volumes, contains discharge records for 164 gaging stations, stage and contents for 32 lakes and reservoirs; water quality for 157 gaging stations, 69 partial-record stations and 54 wells; and water levels for 54 observation wells. Also included are 67 crest-stage partial-record stations and 65 low-flow partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Ohio. (Woodard-USGS)
W78-09738

WATER RESOURCES DATA FOR OHIO, WATER YEAR 1977--VOLUME 1. OHIO RIVER BASIN.
Geological Survey, Columbus, OH. Water Resources Div.
Water-Data Report OH-77-1, May 1978. 518 p, 2 fig.

Descriptors: *Ohio, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites, *Ohio River basin.

Water resources data for the 1977 water year for Ohio consist of records of stage discharge, and water quality of streams; stage, contents and water quality of lakes and reservoirs; and water levels and water quality of ground water. This report in two volumes, contains discharge records for 164 gaging stations, stage and contents for 32 lakes and reservoirs; water quality for 157 gaging stations. 69 partial-record stations and 54 wells; and water levels for 54 observation wells. Also included are 67 crest-stage partial-record stations and 65 low-flow partial-record stations. Additional water data were collected at various sites, not involved in the systematic data-collection program, and are published as miscellaneous measurements. These data represent that part of the National Water Data System collected by the U.S. Geological Survey and cooperating State and Federal agencies in Ohio. (Woodard-USGS)
W78-09739

WATER RESOURCES DATA FOR KANSAS, WATER YEAR 1977.
Geological Survey, Lawrence, KS. Water Resources Div.
Water-Data Report KS-77-1, January 1978. 618 p, 9 fig, 4tab.

Descriptors: *Kansas, *Hydrologic data, *Surface waters, *Groundwater, *Water quality, Gaging stations, Streamflow, Flow rates, Sediment transport, Water analysis, Water temperature, Chemical analysis, Lakes, Reservoirs, Water wells, Water levels, Data collections, Sites.

Water resources data for the 1977 water year for Kansas consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and water levels and water quality in wells. This report contains discharge for 149 gaging stations; stage and contents for 20 lakes and reservoirs; water quality for 77 gaging stations and 2 lakes; and water levels for 463 observation wells and water quality for 269 wells. Also included are data for 132 crest-stage partial-record stations and 23 low-flow partial-record stations. These data represent that part of the National Water Data System operated by the U.S. Geological Survey and cooperating State and Federal agencies in Kansas. (Woodard-USGS)
W78-09740

GROUND-WATER BASIC DATA FOR DICKEY AND LA MOURE COUNTIES, NORTH DAKOTA,
Geological Survey, Bismarck, ND. Water Resources Div.
C. A. Armstrong, and S. P. Luttrell.
North Dakota State Water Commission, Bismarck, County Ground-Water Studies 28--Part II, and North Dakota Geological Survey Bulletin 70--Part II, 1978. 557 p, 2 fig, 1 plate, 7 tab, 25 ref.

Descriptors: *Groundwater, *Water wells, *Logging(Recording), *Water levels, *Water quality, Aquifers, Observation wells, Well data, Hydrologic data, *North Dakota, Dickey County, LaMoure County.

This report contains basic data for 1,473 wells and test holes. It includes 800 logs of test holes and wells, 442 chemical analyses of water samples, 9 chemical analyses of minor elements in ground water, water-level measurements in 174 observation wells, and 11 particle-size analyses. The data may be used for evaluating ground water and geological conditions in Dickey and LaMoure Counties, North Dakota. (Woodard-USGS)
W78-09743

WATER RESOURCES INVESTIGATIONS IN FLORIDA 1977-78.
Geological Survey, Tallahassee, FL. Water Resources Div.
For primary bibliographic entry see Field 9D.
W78-09745

SUMMARY OF WATER RESOURCES FOR THE CAMPO, CUYAPAIPE, LA POSTA, AND MANZANITA INDIAN RESERVATIONS AND VICINITY, SAN DIEGO COUNTY, CALIFORNIA,
Geological Survey, Menlo Park, CA. Water Resources Div.
W. R. Moyle, Jr., and D. J. Downing.
Open-file report 77-684, March 1978. 43 p, 2 fig, 1 plate, 9 tab, 19 ref.

Descriptors: *Groundwater resources, *Indian reservations, *California, *Aquifer characteristics, *Water quality, Water wells, Water yield, Water levels, Streamflow, Runoff, Domestic water, Water supply, Water analysis, Chemical analysis, Well data, San Diego County, Campo, Cuyapaipe, La Posta, Manzanita.

Since 1945, precipitation and runoff in California on the Campo, Cuyapaipe, La Posta, and Manzanita Indian Reservations and surrounding areas generally have been below normal, and groundwater levels are declining. Most of the water is of excellent quality. The analysis of water from one well on the Campo Reservation indicates a concentration of nitrate that exceeds the recommended limit established in 1972 by the U.S. Environmental Protection Agency. Most wells and springs in the study area yield water for domestic purposes. The yields range from less than 1 gallon per minute to 210 gallons per minute. Most of the water is produced from shallow aluvial-filled channels or from consolidated rocks that are deeply weathered locally or highly fractured. The well data show that insufficient water is available on the four reservations for large-scale irrigation. (Woodard-USGS)
W78-09746

A DESCRIPTION OF THE INDEX OF ACTIVE FLORIDA WATER DATA COLLECTION STATIONS AND A USER'S GUIDE FOR STATION OR SITE INFORMATION RETRIEVAL COMPUTER PROGRAM FINDEX H578,
Geological Survey, Tallahassee, FL. Water Resources Div.
M. L. Merritt.
Open-file report 77-703, February 1978. 70 p, 10 fig, 3 tab.

Descriptors: *Information retrieval, *Computer programs, *Florida, *Hydrologic data, *Stations, Methodology, Data storage and retrieval, Water resources, Water quality, Surface waters, Groundwater, Indexing, *Computer program FINDEX.

A computerized index of water-data collection activities and retrieval software to generate publication list of this information was developed for Florida. This system serves a vital need in the administration of the many and diverse water-data collection activities. Previously, needed data was very difficult to assemble for use in program planning or project implementation. Largely descriptive, the report tells how a file of computer card images has been established which contains entries for all sites in Florida at which there is currently a water-data-collection activity. Entries include information such as identification number, station name, location, type of site, county, information about data collection, funding, and other pertinent details. The computer program FINDEX selectively retrieves entries and lists them in a format suitable for publication. Updating the index is done routinely. (Woodard-USGS)
W78-09747

SELECTED HYDROLOGIC DATA, YAMPA RIVER BASIN AND PARTS OF THE WHITE RIVER BASIN, NORTHWESTERN COLORADO AND SOUTH-CENTRAL WYOMING,
Geological Survey, Denver, CO. Water Resources Div.
T. F. Giles, and R. E. Brogden.
Available from the OFSS Branch of Distribution, USGS, Box 25425 Fed. Ctr. Denver, Colo. 80225.
Open-file report 78-23, January 1978. 91 p, 1 fig, 2 plates, 5 tab, 7 ref.

Descriptors: *Hydrologic data, *Water quality, *Surface waters, *Groundwater, *Data collections, Sites, Water analysis, Streamflow, Gaging stations, Climatic data, Snow surveys, Geological units, Coals, *Colorado, *Wyoming, *Yampa River basin(Colo-Wyo), *White River basin(Colo-Wyo).

Selected hydrologic data are presented from four energy-related projects conducted by the U.S. Geological Survey in the Yampa River basin and parts of the White River basin in northwestern Colorado and south-central Wyoming. Water-quality data during 1974 and 1975 and parts of 1976 for 129 ground-water sites and 119 surface-water sites are tabulated. For most samples, major cations, anions, and trace metals were analyzed. For the same time period, field measurements of specific conductance, temperature, and pH were made on 252 springs and wells. These samplings sites, as well as the locations of 20 climatological stations, 18 snow-course sites, and 43 surface-water gaging stations, are shown on maps. Geologic units that contain coal deposits or supply much of the water used for stock and domestic purposes in the area also are shown on a map. (Woodard-USGS)
W78-09748

IDENTIFICATION, INDEXING AND EXCHANGE OF DATA ON ENVIRONMENTAL POLLUTANTS,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5A.
W78-09749

HYDROLOGIC DATA FOR MOUNTAIN CREEK, TRINITY RIVER BASIN, TEXAS, 1976,
Geological Survey, Austin, TX. Water Resources Div.
H. D. Buckner.
Open-file report 77-800, April 1978. 20 p, 1 fig.

Descriptors: *Hydrologic data, *Water quality, *Streamflow, *Runoff, *Reservoir storage, Drainage area, Gaging stations, Flow rates, Chemical analysis, *Texas, *Mountain Creek, *Trinity River basin(Tex).

The total drainage area of Mountain Creek, Texas, is 304 sq mi. The stream-gaging stations on Mountain Creek near Cedar Hill and Walnut Creek near Mansfield provide hydrologic data to define runoff characteristics from small drainage basins. They also serve as index stations for inflow into the reservoir and provide operational data for the reservoir. In addition, the station Walnut Creek near Mansfield is equipped with a recording rain gage. The stage station near Duncanville provides data pertinent to operation of the gates in the Mountain Creek Lake Dam. The reservoir-content station at the dam provides records of reservoir state and contents. The stream-gaging station Mountain Creek at Grand Prairie provides records of outflow from Mountain Creek Lake and the basin. Basin outflow for the 1976 water year was 78,660 acre-feet which is only 1,140 acre-feet above the 16-year (1960-76) average of 77,520 acre-feet. Storage in Mountain Creek Lake showed a net gain of 760 acre-feet during the water year. Rainfall over the study area for the 1976 water year was about 32 inches, which is about 2 inches below the long-term mean rainfall (1960-75) for the area. (Woodard-USGS)
W78-09751

PUBLIC WATER SUPPLIES OF NORTH CAROLINA, A SUMMARY OF WATER SOURCES, USE, TREATMENT, AND CAPACITY OF WATER-SUPPLY SYSTEMS,
Geological Survey, Raleigh, NC. Water Resources Div.
For primary bibliographic entry see Field 5F.
W78-09753

GEOCHEMICAL AND HYDROLOGIC DATA FOR WELLS AND SPRINGS IN THERMAL-SPRING AREA OF THE APPALACHIANS,
Geological Survey, Reston, VA. Water Resources Div.
W. A. Hobba, Jr., J. C. Chemerys, D. W. Fisher, and F. J. Pearson, Jr.

Descriptors: *Thermal springs, *Water quality, *Geochemistry, *Cold springs, *Appalachian Mountain Region, Water wells, Water yield, Water levels, Hydrogeology, Water analysis, Chemical analysis, Radioisotopes, Stable isotopes, Gases.

Data were collected during a one-year reconnaissance of 9 thermal spring areas of the Appalachians from New York to Georgia. Maps show locations of selected wells, warm springs, and cold springs. Physical tables list hydrologic and geologic information on the springs and wells. The chemical tables include dissolved gas concentrations (oxygen, nitrogen, argon, methane, carbon dioxide and helium), isotope contents (tritium, carbon-13, and oxygen-18), some trace and minor element chemical data, and concentrations of the major chemical constituents. Methods of collection and analysis are described. (Woodard-USGS)
W78-09754

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEAR 1978,
Geological Survey, Cheyenne, WY. Water Resources Div.
For primary bibliographic entry see Field 9D.
W78-09756

PENNSYLVANIA, ANNUAL PROGRESS REPORT 1977, (USGS-WRD).
Geological Survey, Harrisburg, PA. Water Resources Div.
Pennsylvania District report, 1977. 87 p.

Descriptors: *Water resources, *Projects, *Pennsylvania, Surface waters, Groundwater, Water quality, Streamflow, Gaging stations, Water analysis, Reservoirs, Mapping, Measurement, Sampling, Sites, Bibliographies, Publications, *U.S. Geological Survey, Annual summary report.

This report describes the projects, the accomplishments, and the activities of the Water Resources

Division of the U.S. Geological Survey resources programs over the 1977 fiscal year in the Commonwealth of Pennsylvania. The diversification of the projects reflects the growth and the national interests of the United States. They show the problems and challenges that present day managers, developers, and users of water face in these times of natural resources conflicts. (Woodard-USGS)
W78-09758

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY, WATER RESOURCES DIVISION, OKLAHOMA DISTRICT.
Geological Survey, Oklahoma City. OK. Water Resources Div.
For primary bibliographic entry see Field 9D.
W78-09759

U.S. RESERVOIR INVENTORY,
National Reservoir Research Program, Fayetteville, AR.
For primary bibliographic entry see Field 4A.
W78-09797

8. ENGINEERING WORKS

8B. Hydraulics

TESTS OF LOW-DENSITY MARINE LIMESTONE FOR USE IN BREAKWATERS,
Coastal Engineering Research, Center, Fort Belvoir, VA.
D. M. Allison, and R. P. Savage.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A028 344, Price codes: A03 in paper copy, A01 in microfiche. Technical Paper No. 76-4, May 1976. 43 p, 9 fig, 8 tab, 6 ref, 2 append.

Descriptors: *Coastal structures, *Breakwaters, *North Carolina, *Riprap, *Waves(Water), *Limestones, Stabilization, Stability, Jetties, Rocks, Limestones, *Armor, *New Bern(NC), *Fort Macon(NC), Rubble mound.

A porous, low-density limestone (Cemented shell stone) available from a quarry in New Bern, North Carolina, was tested in a wave tank as a possible armor layer in coastal structures. Tests were conducted with various wave periods and wave heights. Stones were weighed before and after the stability tests. The stability coefficients were determined for all the tests. It was observed that the stones lost an average of 5.5% of their original weights at the end of the tests. Some of the stones also were placed near a jetty in Fort Macon, North Carolina. At the end of 18 months, the stones near the jetty lost an average of 45-65% of their original weights. It was recommended that these stones should not be used either as a cover or underlayers of rubble-mound coastal structures. (Bhowmik-ISWS)
W78-09360

TAKE THE PICK AND SHOVEL WORK OUT OF COMPUTATION,
For primary bibliographic entry see Field 7C.
W78-09372

CHICAGO PIONEERS IN CORRECTING WATER POLLUTION, CONTROLLING FLOODS.
For primary bibliographic entry see Field 5D.
W78-09375

FLOAT TETHER TERMINATOR,
N. W. Lane, Jr.
U.S. Patent No. 4,068,479, 6 p, 9 fig, 16 p; Official Gazette of the United States Patent Office, Vol. 966, No. 3, p 894, January 17, 1978.

Descriptors: *Patents, *Engineering structures, *Breakwaters, Floating, Coastal structures, Waves(Water), Shore protection, Stress, Tether lines.

Floating breakwater units utilize a series of tethered floats connected to a submerged ballast to dimminish the force and size of waves generated in the water. It is essential that the tether line length for the unit be consistent throughout the floats in order to provide the uniform and most efficient operation in the absorption of wave energy to diminish the size and force of waves. The criticality of the length of the tether lines is of such importance that the tolerance is very small and the uniform length must be specifically maintained throughout the breakwater unit. This invention is a terminator unit having a flexible central neck portion which acts as the pendulum pivot area for the relative motion between the floats and ballast, reducing or substantially eliminating the fatigue which is normally exerted upon the tether line. The terminator has a head junction and a base junction connected or integrally formed on the respective ends of the center neck portion. The head junction is designed to receive one end of the tether line in a unique wrapping configuration through the head junction, so that the tether line is in axial alignment with the central neck portion so as to transfer tension of the tether line in a straight line to the central neck portion. (Sinha-OEIS)
W78-09429

MARYSVILLE LAKE HYDROTHERMAL STUDY; REPORT 2, 2250-MW PROJECT; HYDRAULIC AND MATHEMATICAL MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
M. S. Dortch.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A052 655, Price codes: A03 in paper copy, A01 in microfiche. Technical Report H-77-5, February 1978 (Report 2 of a series). 40 p, 7 tab, 12 pl.

Descriptors: *Hydrothermal studies, *Hydroelectric plants, *Mathematical models, *Hydraulic models, *Pumped storage, Water temperature, California, *Marysville Lake(Calif).

This study was conducted to determine the effect that the proposed Marysville Lake pump-storage hydropower (2250-mw power plant) project would have on downstream water temperatures. A one-dimensional numerical model was used for simulation and prediction of temperatures within and downstream of Marysville Lake. Two physical hydraulic models were used for study and description of the hydrodynamic response of the project. Information from the physical models was necessary to determine coefficients used by algorithms within the mathematical model. The mathematical model allowed simulation of the heat exchange characteristics so the thermal regimes within and downstream of the lake could be determined for various hydrologic and meteorologic conditions and various pumped-storage hydropower operations. Results of the study indicate that the temperatures should be within the objective band desired downstream during years with average or wetter than average hydrologic conditions. (WES)
W78-09466

LAKE ERIE INTERNATIONAL JETPORT MODEL FEASIBILITY INVESTIGATION; REPORT 10, NONTECHNICAL SUMMARY OF PROJECT,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 6G.
W78-09467

BREAKWATER STABILITY STUDY, IMPERIAL BEACH, CALIFORNIA; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
D. G. Markle, and R. D. Carver.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A048 036, Price codes: A07 in paper copy, A01 in microfiche. Technical Report H-77-22, December 1977. 130 p, 21 pl, 2 tab, 82 photo, 7 ref.

Descriptors: *Breakwaters, *Groins(Structures), *Hydraulic models, California, *Beach nourishment, *Armor units(Hydraulics), *Imperial Beach(Calif), *Rubble-mound breakwaters, High-sill structures, Low-sill structures, Overtopping.

A hydraulic model investigation was conducted at a geometrically undistorted scale of 1:16, model to prototype, to desgin stable rubble-mound breakwater sections to protect a beach nourishment area at Imperial Beach, California. Both the -5.0 ft mllw contour (shallow-water location) and -10.0 ft mllw contour (deeper water location) were given as proposed construction sites. Twenty-one plans were tested, resulting in two adequate breakwater designs for each of the two proposed sites. A constant high-sill structure, using 3-ton graded armor stone, and an alternative high- and low-sill structure, using 5- and 0.5-ton armor stone, were stable for the design conditions at the shallow-water location. Two alternating high- and low-sill structures proved adequate for the design condition at the deeper water location. One used 5- and 3-ton graded armor stone on the breakwater trunks and 7-ton cap-stone on the ends of the breakwater system on 1V-on-3H side slopes while the other design used trunk sections of 7- and 5-ton graded armor stone on 1V-on-2H side slopes and 7-ton capstone on the head section with 1V-on-3H side slopes. (WES)
W78-09469

DOLOS ARMOR UNITS USED ON RUBBLE-MOUND BREAKWATER TRUNKS SUBJECTED TO NONBREAKING WAVES WITH NO OVERTOPPING,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
R. D. Carver, and D. D. Davidson.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A048 434, Price codes: A05 in paper copy, A01 in microfiche. Technical Report H-77-19, November 1977. 63 p, 4 tab, 22 photos, 18 pl, 1 append, 11 ref, 5 fig.

Descriptors: *Breakwaters, *Waves(Water), Design criteria, *Dolosse, *Rubble-mound breakwaters, *Armor units(Hydraulics), *Wave runup.

This investigation describes a portion of a research effort to provide fundamental data for the design of rubble-mound breakwaters. This report addresses the use of dolos armor on breakwater trunks subjected to nonbreaking waves and with no overtopping. The majority of the tests reported herein were designed to determine the stability coefficient, K, and runup and rundown values for the above conditions. Additional limited tests were conducted to show what effects (1) varying the first underlayer stone material from 1/5 to 1/20 of the armor weight (Wr) would have on armor stability, wave runup, and wave rundown; (2) placing the dolosse in selected geometric patterns would have on stability; and (3) reducing the number of dolosse used in the cover layer would have on stability. Test results show that a stability coefficient, k = 31, is reasonable for nonbreaking waves on breakwater trunks if the density of units per given areas is equal to or greater than 0.83V-2/3, i.e., n = 2, K delta = 0.94, P = 56%. (WES)
W78-09470

PORT ONTARIO HARBOR, NEW YORK, DESIGN FOR WAVE PROTECTION AND PREVENTION OF SHOALING; HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
R. R. Bottin, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A049 246, Price codes: A07 in paper copy. Technical Report H-77-20, November 1977. 128 p, 16 tab, 65 photos, 12 pl, 1 append, 20 ref.

Descriptors: *Breakwaters, Harbors, *Hydraulic models, Waves(Water), New York, *Port Ontario Harbor(NY), *Shoaling, *Wave protection.

A 1:75-scale undistorted hydraulic model of Port Ontario Harbor, New York, which included the lower 5,700 ft of the Salmon River, approximately 4,300 ft of shoreline on each side of the river mouth, Selkirk Lake, and sufficient offshore area in Lake Ontario to permit generation of required test waves, was used to shoaling, wave protection, and riverflow conditions. Proposed improvement plans consisted of (1) breakwaters in Lake Ontario at the mouth of the Salmon River; (2) an entrance channel; (3) an inner channel; (4) a harbor basin; and (5) recreational facilities. A 60-ft-long wave generator, a model circulation system, crushed coal tracer material, and an automated data acquisition and control system (ADACS) were utilized in model operation. It was concluded from model test results that: Wave heights in the harbor were within the established wave-height criteria (2.0 ft at the river mouth and 0.5 ft in the mooring area) for all major improvement plans tested. Of the improvements plans involving the first breakwater configuration and channel alignment tested (Plans 2-5), Plan 4 was selected as the optimum with respect to shoaling protection and construction cost. (WES)
W78-09475

COMPARISON OF NUMERICAL AND PHYSICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA,
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2L.
W78-09477

COMPARISON OF NUMERICAL AND PHYSICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA; APPENDIX 1: FIXED-BED HYDRAULIC MODEL RESULTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 2L.
W78-09478

COMPARISON OF NUMERICAL AND PHYSICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA; APPENDIX 2, NUMERICAL SIMULATION OF HYDRODYNAMICS (WRE),
Water Resources Engineers, Inc., Austin, TX.
For primary bibliographic entry see Field 2L.
W78-09479

COMPARISON OF NUMERICAL AND PHYSICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA: APPENDIX 3, NUMERICAL SIMULATION OF HYDRODYNAMICS (TRACOR),
Coastal Engineering Research Center, Fort Belvoir, VA.
For primary bibliographic entry see Field 2L.
W78-09480

COMPARISON OF NUMERICAL AND PHYSICAL HYDRAULIC MODELS, MASONBORO INLET, NORTH CAROLINA; APPENDIX 4, SIMPLIFIED NUMERICAL (LUMPED PARAMETER) SIMULATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 2L.
W78-09481

8C. Hydraulic Machinery

U-TUBE CONNECTIONS FOR WASTEWATER PONDS,
Tenneco Chemicals, Pasadena, TX.
R. Churchwell, and A. Fox.
Chemical Engineering, Vol. 85, No. 11, p 212, May, 1978. 3 fig.

Descriptors: *Pipes, *Tubes, *Gravity, *Conveyance structures, *Conduits, Water conveyance, Iron, Storage tanks, Water levels, Oily water, Skimming, Waste water treatment, Municipal wastes.

A U-shaped tube for returning floating solids from a holding pond to a skimmer-equipped pond is readily adjustable to varying heights. The ends of the U-tube pipe apparatus are equipped with angle irons located at 120 degree intervals around the pipe's circumference. The angle irons support additional pipe rings for increasing the height of the U-tube. Surface scum and floating materials are transferred from the feed pond to the skimmer pond by adjusting the height of the U-tube with the pipe rings to the required level in the feed pond. The back-bevelled pipe rings, which are hung on the angle irons when not in use, are easily assembled and alleviate leakage. Gravity flow through the U-tube can be sustained in either direction. (Lisk-FIRL)
W78-09374

COMPUTER-CONTROLLED PLANT FEATURES ADVANCED TREATMENT.
For primary bibliographic entry see Field 5D.
W78-09389

AUTOMATIC CONTROL OF A DIFFUSED AIR TREATMENT PLANT,
For primary bibliographic entry see Field 5D.
W78-09397

AUTOMATIC CONTROLS PREVENT CHLORINE SPILL HAZARDS,
For primary bibliographic entry see Field 5D.
W78-09399

ENSURING CLARITY AND ACCURACY IN TORQUE DETERMINATIONS,
W. H. Boyle.
Water and Sewage Works, Vol. 125, No. 3, p 76-77, March, 1978. 1 fig, 1 tab.

Descriptors: *Structural design, *Flow characteristics, *Settling basins, *Hydraulic systems, *Hydrodynamics, Analytical techniques, Equipment, Design criteria, Sludge treatment, Rotors, Waste water treatment, Municipal wastes.

Methods were developed to calculate running, alarm, shut-off, and peak torques for circular clarifiers. Torque may be represented as the squared product of the uniform sludge load and the radius of the clarifier. The drive unit of the clarifier usually operates at a single running torque for 90% of the time. Alarm torque, set at 120% of the running torque, warns of loads in excess of the design clarifier parameters, provides additional running torque, and protects the drive unit in the presence of excessive loads. Shut-off torque automatically stops operation of the clarifier under adverse or abnormal conditions and may be set at 140% of the running torque. Peak torque, determined by the manufacturer to be the absolute capacity of the drive unit, accommodates excessive loads for a duration of about 3 sec when torque increases too rapidly for the shut-off torque to respond; peak torque is usually twice the running torque. Torque values were calculated for a municipal primary clarifier with an 80-ft diameter and a uniform sludge load of 8 lbs/ft. From the initial torque equation and the modes of torque operation, torque values were calculated as 132,800 ft lbs for running, 15,360 ft lbs for alarm, 17,920 ft lbs for shut-off, and 25,600 ft lbs for peak torque. (Lisk-FIRL)
W78-09413

FACTORS INFLUENCING LOW SPEED SURFACE AERATION SELECTION,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5D.
W78-09414

INSURING TROUBLE-FREE PUMP OPERATION,
Allis-Chalmers Corps., Milwaukee, WS. Industrial Pump Div.
A. LaFarge.
Water and Sewage Works, Vol. 125, No. 5, p 60-63, May, 1978. 6 fig.

Descriptors: *Pumps, *Piping systems(Mechanical), *Foundations, *Pumping plants, *Cement grouting, Construction materials, Operation and maintenance, Pipelines, Waste water treatment, Transport, Municipal wastes.

Recommendations are reviewed for improving the installation and operation of pumps used in waste water treatment facilities. Flooding of pumps installed in low-lying areas requires cleaning and greasing of the bearings, stuffing box, mechanical seals, couplings, impeller, and pipes. Location, foundation, alignment, and piping are considered in the installation of pumps. It is recommended that pumps be located near the inlet and below the liquid flow, especially when suction lift pumps are used, to facilitate priming and flow rate. Alignment of the pump by placement on a founcation of blocks and shims is important during installation to prevent uneven wear and ensure proper operation. Grouting around the steel or cast iron base plates stabilizes the alignment and compensates for an uneven foundation beneath the pump. Pipes should have air-tight joints and be installed in the most direct route to the pump. Suction and discharge pipes require supports or anchors to prevent stress. A length of suction pipe 4-5 times the pipe diameter should be installed upstream of the pump to maintain proper flow. Suggestions are made for proper pump maintenance. (Lisk-FIRL)
W78-09441

PROCEEDINGS OF THE SOLAR IRRIGATION WORKSHOP, (1977).
Energy Research and Development, Albuquerque, NM. Sandia Labs.
For primary bibliographic entry see Field 3F.
W78-09448

MARYSVILLE LAKE HYDROTHERMAL STUDY; REPORT 2, 2250-MW PROJECT; HYDRAULIC AND MATHEMATICAL MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 8B.
W78-09466

8D. Soil Mechanics

EROSION PROCESSES ON STEEP GRANITIC ROAD FILLS IN CENTRAL IDAHO,
Forest Service (USDA) Boise, ID. Intermountain Forest and Range Experimental Station.

For primary bibliographic entry see Field 2J.
W78-09330

CONSTRUCTION OF FROZEN FILL DAMS IN ARCTIC COASTAL REGIONS,
P. A. Grishin.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A041 248, Price codes: A02 in paper copy, A01 in microfiche. CRREL Draft Translation 624, July 1977. 14 p, 6 fig. Translated from Trudy IV Soveshchaniya-Seminara po Obmenu Opytom Stroitel'stva v Surovykh Klimaticheskikh Usloviyakh (USSR), Vol 10, 14 p, 1976.

Descriptors: *Dam construction, *Coasts, *Cold regions, *Frozen soils, Dams, Cold weather construction, Earthworks, Earth dams, Dam design, Arctic, Temperature, *USSR, Frozen-fill dams.

Expansion of industrial and public construction in the Arctic resulted in an increase in the demand for drinking and industrial water and necessitated the construction of dams and reservoirs. The severe weather and complex geocryological-geological conditions require the construction of frozen-fill type dams as the most economical and technologically justified hydroengineering installations for that region. Plans have been developed for different designs of frozen dams for the Arctic coastal regions. Some of the dams have been built and are operating successfully, while others are not yet complete and are under observation. This article set forth the results of observations, analysis of deviations from plans during the construction of installations, and experience in their operations. (Humphreys-ISWS)
W78-09363

SHORELINE EROSION IN SOUTHEASTERN WISCONSIN,
Wisconsin Geological and Natural History Survey, Madison.
For primary bibliographic entry see Field 2J.
W78-09547

8G. Materials

PROGRAM THE MANNING EQUATION,
Camp, Dresser, and McKee Inc., Boston, MA.
For primary bibliographic entry see Field 7B.
W78-09376

KNOW-HOW IMPORTANT IN REHABILITATING FLOODED SEWER LINES,
Pennsylvania Dept. of Public Works, Johnstown.
R. W. Malysko.
Public Works, Vol. 109, No. 5, p 62-64, May, 1978.

Descriptors: *Cleaning, *Sewers, *Flood damage, *Storm drains, *Debris avalanches, Historic floods, Pipelines, Equipment, Concrete pipes, Clogging, Conduits, Jets, Pumps, Sewerage, Municipal wastes.

Water jetting, bucket machines, rodding, and scrapers were utilized by Robinson Pipe Cleaning, Co., of Canonsburg, Pennsylvania, to remove debris from sewer lines in Johnstown, Pennsylvania, after the July 1977 flood. Water and debris were cleared from basements and elevator shafts by trash pumps and water jetting; water was discharged to open sewer lines or transported by 3,000 gal tank trucks to the Conemaugh River. Main sewer lines leading to the 25 mgd sewage treatment plant were initially cleared to restore the flow in 145 miles of municipal sewers. The concrete or terra cotta pipes, with diameters ranging over 8-60 inches, were cleaned with bucket machines and high-velocity water jetting, in sections averaging the distance between 2-3 manholes. More than 80 miles of brick, stone or concrete storm sewers with diameters ranging from 18-96 inches were cleared by rodding scrapers attached bucket winches. Debris removed from the lines, such as tree limbs, mud, rock, road base materials, telephone poles, railroad ties, and auto parts, were deposited in dump trucks by clamshell equipment or tractor shovels for subsequent disposal. (Lisk-FIRL)
W78-09377

EFFLUENT TREATMENT PROCESS USES FILAMENT-WOUND GLASS FIBER/EPOXY.
Reinforced Plastics, Vol. 22, No. 2, p 52-53, February, 1978.

Descriptors: *Plastic pipes, *Epoxy resins, *Construction materials, *Shafts(Excavations), *Pipes, Tensile strength, Chlorides, Corrosion control, Industrial wastes, Waste water treatment, Steel pipes, Aeration, Municipal wastes/

Glass-reinforced plastic was selected as piping material for the installation of a deep shaft effluent treatment system at the Marsh Farm Sewage Works in Tilbury, Essex, England. Because the combined municipal and industrial waste water treated at the plant had a high chloride level, the deep shaft equipment had to be resistant to corrosion for a period of 30 yrs. The 132-m long filament-wound fiberglass epoxy downcomer, with a 1,200 mm diameter, hangs freely in a 130-m deep shaft with a 2-m diameter. The fiberglass epoxy pipe was delivered in 10-m sections and joined with a locking system and resin injection to insure tensile strength and rigidity. Effluent is passed through a bell-mounted T-piece to the downcomer, equipped with stainless steel aeration pipes. The fiberglass reinforced plastic pipes are manufactured by Wavin Plastics Ltd. of Hayes, Middlesex, England. (Lisk-FIRL)
W78-09383

SYMPOSIUM ON APPLIED GLACIOLOGY.
International Glaciological Society, Cambridge (England).
For primary bibliographic entry see Field 2C.
W78-09603

ENGINEERING PROPERTIES OF SNOW,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2C.
W78-09604

SNOW FORCES,
Eidgenossisches Inst. fuer Schnee- und Lawinenforschung, Davos (Switzerland).
For primary bibliographic entry see Field 2C.
W78-09605

DIRECT SIMPLE SHEAR TESTS ON SNOW AND THEIR RELATION TO SLAB AVALANCHE FORMATION,
Norwegian Geotechnical Inst., Oslo.
For primary bibliographic entry see Field 2C.
W78-09606

A FRACTURE CRITERION FOR SNOW,
Montana State Univ., Bozeman. Dept. of Civil Engineering and Engineering Mechanics.
For primary bibliographic entry see Field 2C.
W78-09607

THE KINETIC FRICTION ON SNOW AND ICE,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
For primary bibliographic entry see Field 2C.
W78-09609

ICE FORCES,
Technical Univ. of Denmark, Lyngby (Denmark). Inst. of Hydrodynamics and Hydraulic Engineering.
For primary bibliographic entry see Field 2C.
W78-09619

ICE-STRUCTURE INTERACTION WITH ARTIFICIALLY GENERATED FORCE RECORDS,
Memorial Univ. of Newfoundland, St. John's. Faculty of Engineering and Applied Science.
For primary bibliographic entry see Field 2C.
W78-09620

MECHANISMS AND THEORY OF IDENTATION OF ICE PLATES,
Laval Univ., Quebec. Lab. of Ice Mechanics.
For primary bibliographic entry see Field 2C.
W78-09621

ICE ACCRETIONS ON STRUCTURES,
Toronto Univ. (Ontario). Dept. of physics.
For primary bibliographic entry see Field 2C.
W78-09636

DE-ICING OF RADOMES AND LOCK WALLS USING PNEUMATIC DEVICES,
Cold Regions Research and Engineering Lab., Hanover, NH.
For primary bibliographic entry see Field 2C.
W78-09637

SNOW ACCRETION ON ELECTRIC WIRES AND ITS PREVENTION,
Hokkaido Univ., Sapporo (Japan). Inst. of Low Temperature Science.
For primary bibliographic entry see Field 2C.
W78-09638

ENGINEERING PROPERTIES OF SEA ICE,
Hamburgische Schiffbau-Versuchsanstalt (West Germany).
For primary bibliographic entry see Field 2C.
W78-09640

8I. Fisheries Engineering

ASSESSMENT OF DAMAGE TO FISH LARVAE BY ENTRAINMENT SAMPLING WITH SUBMERSIBLE PUMPS,
Wisconsin Electric Power Co., Milwaukee.
J. J. Ney, and P. D. Schumacher.
Environmental Science and Technology, Vol. 12, No. 6, p 715-716, 1978. 1 tab, 5 ref.

Descriptors: *Entrainment, *Larval growth stage, Larvae, *Sampling, *Suckers, Plankton, *Fry, *Monitoring, *Pumps, *Cooling water, *Intakes, *Fish eggs, Data collections, Testing procedures, *Ichthyoplankton.

White sucker larvae were passed through a submersible pump-plankton net system to assess the physical effects of this sampling devise on ichthyoplankton. Larvae destruction was negligible, and incidence of maiming was very low in the collection process. Prolonged (6 h) pumping of water and debris into a plankton net containing larvae resulted in a mean apparent recapture loss of 18%. Approximately half of the sucker fry recovered after prolonged pumping were maimed. The submersible pump-plankton net combination appears to be an effective device to monitor ichthyoplankton entrainment, although frequent removal of collected material may be warranted. (EIS-Deal)
W78-09302

FILTERING SYSTEM FOR FISH-FARMING WATER,
For primary bibliographic entry see Field 5F.
W78-09427

9. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, and Research Act Allotments

WATER RESOURCES INVESTIGATIONS IN FLORIDA 1977-78.
Geological Survey, Tallahassee, FL. Water Resources Div.
Florida District report, March 1978. 146 p.

Descriptors: *Water resources development, *Florida, Reviews, *Projects, *Publications, Bibliographies, U.S. Geological Survey, Participating agencies.

Summary statements for water-resources investigations in Florida conducted by the Water Resources Division of the U.S. Geological Survey in cooperation with State, Federal, and local agencies during 1977-78 are contained in this report. These investigations are part of the Federal program of appraising the Nation's water resources. Water resource investigations in Florida range from basic descriptive water-availability studies for areas of low-intensity water development and management to sophisticated cause and effect studies in areas of high-intensity water development. The interpretative reports and records that are products of the investigations are a principal hydrologic foundation upon which the plans and development of Florida's water resources may be based. Reports released during 1977 are listed. Preceding the investigative summaries is a map showing location of areal investigations; a list classifying investigations by hydrologic topics, and a numerical list of investigations. A list of agencies which cooperated in the statewide water resources program is included. (Woodard-USGS)
W78-09745

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY IN WYOMING, FISCAL YEAR 1978,
Geological Survey, Cheyenne, WY. Water Resources Div.
F. C. Boner.
Open-file report 78-239, February 1978. 106 p, 9 fig, 5 tab, 8 ref.

Descriptors: *Water resources, *Surface waters, *Groundwater, *Water quality, *Wyoming, Hydrologic data, Water supply, Streamflow, Flow rates, Sediment transport, Reservoirs, Observation wells, Projects, Publications, Annual, Reviews.

This report contains lists of streamflow and reservoir stations, peak-flow partial-record stations, chemical-quality stations, sediment stations, and observation wells where water levels are measured in Wyoming. The locations of the basic-data sites are shown on maps. Thirty-two water-resources appraisal projects in Wyoming are also described, including many that are related to the development of energy resources. The general locations of the projects are shown on maps. The report serves as an annual progress report to cooperators and the public. (Woodard-USGS)
W78-09756

PENNSYLVANIA, ANNUAL PROGRESS REPORT 1977, (USGS-WRD).
Geological Survey, Harrisburg, PA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09758

WATER-RESOURCES INVESTIGATIONS OF THE U.S. GEOLOGICAL SURVEY, WATER RESOURCES DIVISION, OKLAHOMA DISTRICT.
Geological Survey, Oklahoma City. OK. Water Resources Div.
Oklahoma District report, January 1978. 91 p, 6 fig, 2 tab, 114 ref.

Descriptors: *Water resources, *Projects, *Oklahoma, Surface waters, Groundwater, Water quality, Streamflow, Gaging stations, Water analysis, Reservoirs, Maps, Measurement, Sampling, Sites, Bibliographies, Publications, *U.S. Geological Survey, Annual summary report.

This report is a summary of the 1978 program of the U.S. Geological Survey, Water Resources Division, Oklahoma District. It contains brief descriptions of all active projects and the current status of each. A list of all published reports related to the water resources of Oklahoma is given. It contains listings of all streamflow gaging stations, water quality stations, and reservoir stations which the Geological Survey operates or publishes through cooperation with other State, local, and Federal agencies. Included are discontinued surface water and water quality stations for which the Geological Survey has published records. Stations are listed by type and by cooperator and the number of stations funded by each cooperator is summarized. Maps show the locations of various types of stations, the locations of selected groundwater projects and an index of the two-degree sheets in Oklahoma for which hydrologic reconnaissance studies have been made. (Woodard-USGS)
W78-09759

10. SCIENTIFIC AND TECHNICAL INFORMATION

10B. Reference and Retrieval

COLLECTION, STORAGE, RETRIEVAL, AND PUBLICATION OF WATER-RESOURCES DATA.
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09323

10C. Secondary Publication And Distribution

A GUIDE TO OBTAINING INFORMATION FROM THE USGS 1978,
Geological Survey, Reston, VA.
P. F. Clarke, H. E. Hodgson, and G. W. North.
Available from Branch of Distribution, USGS, 1200 S. Eads St. Arlington, VA 22202. Circular 777, 1978. 36 p.

Descriptors: *Information retrieval, *Publications, *Natural resources, *Water resources, *Indexing, *U.S. Geological Survey documents, *Information retrieval sources, Unpublished documents.

For almost 100 years, the USGS (U.S. Geological Survey) has served Federal, State, and local governments and the public by collecting, analyzing, and publishing detailed information about the Nation's mineral, land, and water resources. This information is released in a variety of map, book, and other formats and is available for free distribution or for sale from sources both within and outside the USGS. This guide has been prepared to assist in obtaining these information products and to aid in locating both general and specific unpublished information within the USGS. (Woodard-USGS)
W78-09309

IDENTIFICATION CODES FOR ORGANIZATIONS LISTED IN COMPUTERIZED DATA SYSTEMS OF THE U.S. GEOLOGICAL SURVEY,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09317

DEFINITIONS OF COMPONENTS OF THE WATER DATA SOURCES DIRECTORY MAINTAINED BY THE NATIONAL WATER DATA EXCHANGE,
CACI Inc., Reston, VA; and Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09319

STORAGE AND RETRIEVAL OF WATER-RESOURCES DATA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 7C.
W78-09327

PUBLICATION OF WATER-RESOURCES DATA,
Geological Survey, Reston, VA. Water Resources Div.
S. M. Lang, and C. B. Ham.
In: Collection, Storage, Retrieval, and Publication of Water-Resources Data: Geological Survey Circular 756, p 26-39, 1978. 9 fig, 7 ref.

Descriptors: *Hydrologic data, *Publications, *Documentation, *Information exchange, *Water resources, Data collections, Methodology, Evaluation, *Reports, *U.S. Geological Survey.

Water data are the raw materials used by scientists and engineers for determining the availability and accessibility of the water resources and for the design, development, and management of major water facilities. The principal responsibility of a hydrologic service is to furnish the scientists and engineers the data they need in a consistent and timely manner. The medium most frequently used for release of water data is the data report. It is the principal product of the major hydrologic services, even in this era of computers with their massive automated data storage and dissemination capabilities. Data publications meet the requirements of a widespread audience; they also provide archival capability that has not yet been equaled by automation techniques. (See also W78-09323) (Woodard-USGS)
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